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U.S. Department of Energy
Idaho Operations Office

# Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory

October 2005

## Idaho Cleanup Project

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# Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory

**October 2005**

**Prepared for the**
**U.S. Department of Energy**
**DOE-NE Idaho Operations Office**

# ABSTRACT

This report summarizes the documentation submitted in support of the five-year review of remedial actions implemented under the Comprehensive Environmental Response, Compensation, and Liability Act sitewide at the Idaho National Laboratory. The report also summarizes documentation and inspections conducted at the no-further-action sites.

This review covered actions conducted at nine of the 10 Waste Area Groups at the Idaho National Laboratory, i.e., Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 9, and 10. Waste Area Group 8 was not subject to this review, because it does not fall under the jurisdiction of the U.S. Department of Energy Idaho Operations Office. The review included past site inspections and monitoring data collected in support of the remedial actions.

The remedial actions have been completed at Waste Area Groups 2, 4, 5, 6, and 9. Remedial action reports have been completed for Waste Area Groups 2 and 4, and remedial action reports are expected to be completed during 2005 for Waste Area Groups 1, 5, and 9. Remediation is ongoing at Waste Area Groups 3, 7, and 10. Remedial investigations are yet to be completed for Operable Units 3-14, 7-13/14, and 10-08.

The review showed that the remedies have been constructed in accordance with the requirements of the records of decision and are functioning as designed. Immediate threats have been addressed, and the remedies continue to be protective. Potential short-term threats are being addressed through institutional controls. Soil cover and cap remedies are being maintained properly and inspected in accordance with the appropriate requirements. Soil removal actions and equipment or system removals have successfully achieved remedial action objectives identified in the records of decision. The next sitewide five-year review is scheduled for completion by 2011.

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## TABLES

# ACRONYMS

| | |
|---|---|
| ACF | area shielding factor |
| ANL-W | Argonne National Laboratory-West |
| ARA | Auxiliary Reactor Area |
| ARAR | applicable or relevant and appropriate requirements |
| ARD | agreement to resolve disputes |
| bls | below land surface |
| BORAX | Boiling Water Reactor Experiment |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFA | Central Facilities Area |
| CFR | Code of Federal Regulations |
| COC | contaminant of concern |
| COPC | contaminant of potential concern |
| CPP | Chemical Processing Plant |
| DCE | dichloroethene |
| D&D | decontamination and decommissioning |
| DE | deep extraction |
| DEQ | Department of Environmental Quality |
| DOE | U.S. Department of Energy |
| DOE Idaho | U.S. Department of Energy Idaho Operations Office |
| DQO | data quality objective |
| DWMCL | drinking water maximum contaminant level |
| EBR | Experimental Breeder Reactor |
| EOCR | Experimental Organic-Cooled Reactor |
| EPA | U.S. Environmental Protection Agency |
| ESD | explanation of significant differences |
| ET | evapotranspiration |
| FD | field drain |

| | |
|---|---|
| FFA/CO | federal facility agreement and consent order |
| FSP | field sampling plan |
| FY | fiscal year |
| GSF | gamma-shielding factor |
| HEAST | Health Effects Assessment Summary Table |
| HEPA | high-efficiency particulate air |
| HIC | high-integrity container |
| HWMA | Hazardous Waste Management Act |
| ICDF | Idaho CERCLA Disposal Facility |
| IDWR | Idaho Department of Water Resources |
| IE | intermediate extraction |
| IET | Initial Engine Test |
| INEEL | Idaho National Engineering and Environmental Laboratory |
| INL | Idaho National Laboratory |
| INTEC | Idaho Nuclear Technology and Engineering Center |
| IRIS | Integrated Risk Information System |
| ISB | in situ bioremediation |
| IWTS | Integrated Waste Tracking System |
| LCCDA | Liquid Corrosive Chemical Disposal Area |
| LDR | land disposal restriction |
| LMAES | Lockheed Martin Advanced Environmental Systems |
| MCL | maximum contaminant level |
| MFC | Materials and Fuels Complex |
| MNA | monitored natural attenuation |
| MRDS | monitoring report/decision summary |
| MSIP | monitoring system and installation plan |
| MWTS | monitoring well and tracer study |
| NA | not applicable |
| NAT | neutron access tube |

| | |
|---|---|
| NOAA | National Oceanic and Atmospheric Administration |
| NODA | Naval Ordnance Disposal Area |
| NPTF | New Pump and Treat Facility |
| NRF | Naval Reactor Facility |
| NSD | notice of soil disturbance |
| NSI | new site identification |
| OCVZ | organic contamination in the vadose zone |
| OMRE | Organic-Moderated Reactor Experiment |
| OU | operable unit |
| PBF | Power Burst Facility |
| PCB | polychlorinated biphenyl |
| PCE | tetrachloroethene (also known as perchloroethylene) |
| PER | Power Excursion Reactor |
| ppb | parts per billion |
| ppm | parts per million |
| PRG | preliminary remediation goal |
| RAO | remedial action objectives |
| RBC | risk-based concentration |
| RBCA | risk-based corrective action |
| RCRA | Resource Conservation and Recovery Act |
| RD/RA | remedial design/remedial action |
| RDX | cyclotrimethylene trinitroamine |
| RfD | reference dose |
| RFTO | recuperative flameless thermal oxidation |
| RI/FS | remedial investigation/feasibility study |
| ROD | record of decision |
| RTC | Reactor Technology Complex |
| RWMC | Radioactive Waste Management Complex |
| SDA | Subsurface Disposal Area |

| | |
|---|---|
| SE | shallow extraction |
| SL-1 | Stationary Low Power Reactor No. 1 |
| SPERT | Special Power Excursion Reactor Test |
| SRPA | Snake River Plain Aquifer |
| SSSTF | staging, storage, sizing, and treatment facility |
| STF | Security Training Facility |
| TAN | Test Area North |
| TBD | to be determined |
| TCA | trichloroethane |
| TCE | trichloroethene |
| TCLP | toxicity characteristic leaching procedure |
| TDR | time-domain reflectometer |
| TFR | technical and functional requirement |
| TNT | trinitrotoluene |
| TRA | Test Reactor Area |
| TRU | transuranic |
| TSF | Technical Support Facility |
| UCL | upper confidence limit |
| $UCL_{90}$ | upper 90% confidence limit |
| UHC | underlying hazard constituent |
| USGS | United States Geological Survey |
| UXO | unexploded ordnance |
| VOC | volatile organic compound |
| WAC | waste acceptance criteria |
| WAG | waste area group |
| WCF | Waste Calcine Facility |
| WRRTF | Water Reactor Research Test Facility |

# Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory

## 1. INTRODUCTION/PURPOSE

The purpose of this five-year review was to ascertain whether completed remedial actions at the Idaho National Laboratory (INL) site remain protective of human health and the environment. For sites where the remedy is incomplete, the focus of the review was to ascertain whether the remedy is being constructed in accordance with requirements of applicable decision documents and design specifications and whether the remedy is expected to be protective when it is competed.

This review was conducted in accordance with the requirements of Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC § 9601 et seq.) and is considered statutory (EPA 1991; EPA 1994; EPA 1995a). As identified in Section 2(d) of Executive Order 12580, "Superfund Implementation," the U.S. Department of Energy (DOE) has the duty and authority by law to conduct five-year reviews at INL. Furthermore, the "National Oil and Hazardous Substances Pollution Contingency Plan," as promulgated in the Code of Federal Regulations (CFR), recognizes in 40 CFR 300.5, "Definitions," that DOE will be the lead agency for INL with regard to conducting five-year reviews. Section 22.1 of the *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory* (DOE-ID 1991a) specifies that the U.S. Environmental Protection Agency (EPA) can review response actions and, with consultation from the Idaho Department of Environmental Quality, determine whether additional action is required by DOE.

In accordance with the federal facility agreement and consent order (FFA/CO) (DOE-ID 1991a), the INL Site was divided into 10 waste area groups (WAGs) to facilitate remedial design/remedial action (Figure 1-1). WAGs 1 through 9 correspond to the primary facility areas at the INL Site. WAG 10 corresponds to the portion of the Snake River Plain Aquifer (SRPA) beneath the INL Site and to surface and subsurface areas not included with CERCLA sites identified in facility-specific records of decision (RODs). The FFA/CO also established operable units (OUs) for specific remedial activities within the WAGs. During the early stages of cleanup, RODs were drafted and implemented for OUs. Comprehensive RODs were subsequently drafted or are being drafted as the cleanup efforts have evolved. Table 1-1 lists the decision documents for each WAG.

As identified in the *Idaho National Engineering and Environmental Laboratory Sitewide Five-Year Review Plan for CERCLA Response Actions* (DOE-ID 2004a), this review represents the first INL "sitewide" five-year review conducted by the DOE. Several WAGs or OUs have undergone five-year reviews in the past; others have not. Because some of the WAGs have undergone individual five-year reviews in the past, fewer than five years might have elapsed since the previous review. However, completion of this review established a consolidated, sitewide, five-year review schedule at the INL Site. Table 1-2 identifies the triggering action and date for the review and presents the number of reviews that have been completed for INL WAGs and OUs. In general, the trigger for this five-year review is initiation of remedial actions or the signature date of the previous five-year review report. Although the trigger dates for the individual WAGs vary, the end date for this review is September 30, 2004, for all WAGs and OUs.

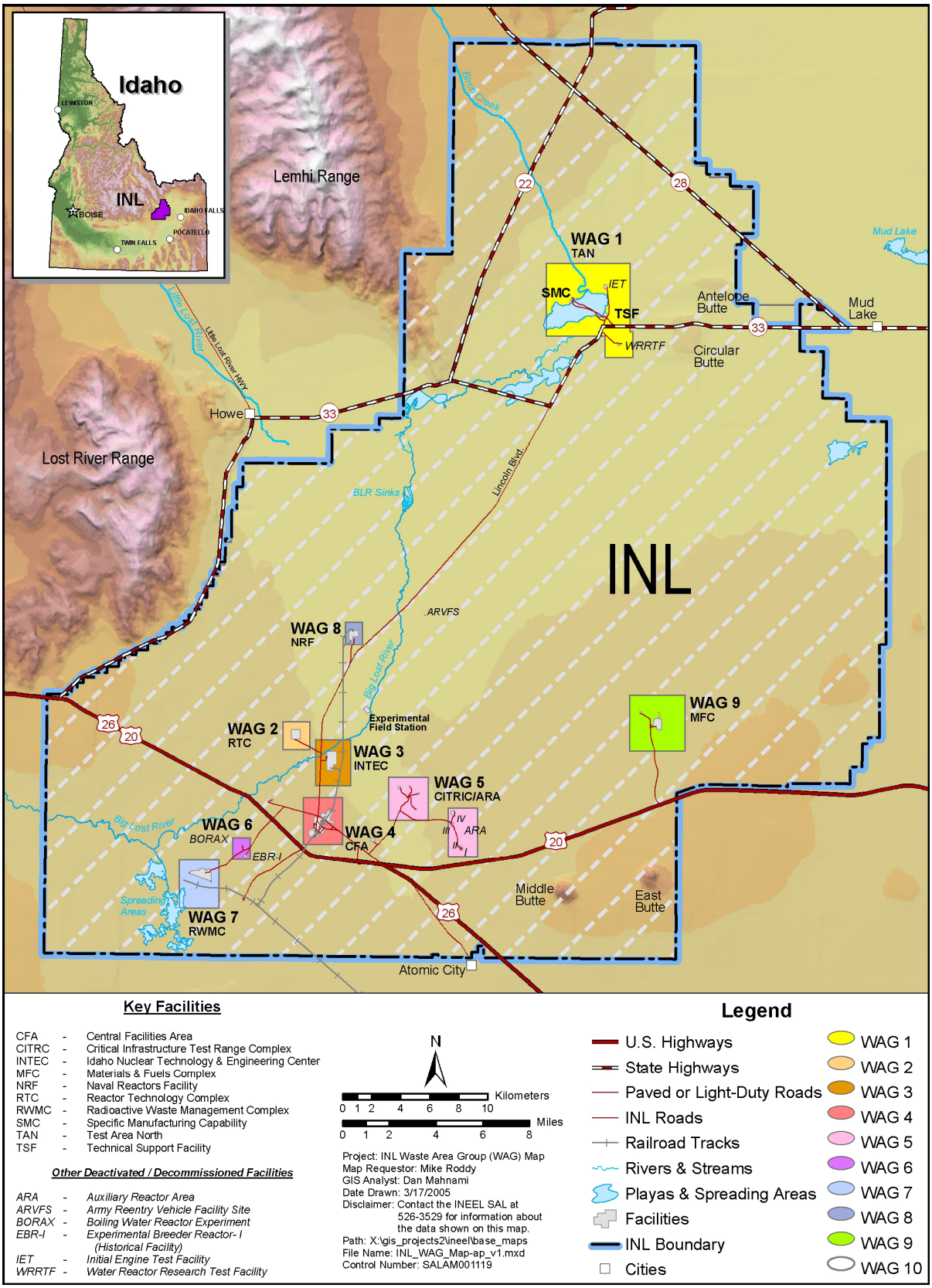


Figure 1-1. INL Site map showing WAG locations.

Table 1-1. Decision documents.

| Date | Decision Document |
|---|---|
| **WAG 1** | |
| September 1992 | *Record of Decision (ROD) for Technical Support Facility (TSF) Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23)* (DOE-ID 1992a) |
| August 1995 | *Record of Decision for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites Final Remedial Action* (DOE-ID 1995a) |
| November 1997 | *Explanation of Significant Differences from the Record of Decision for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites, Final Remedial Action, Operable Unit 1-07B, Waste Area Group 1, Idaho National Engineering and Environmental Laboratory* (INEEL 1997) |
| October 1999 | *Final Record of Decision for Test Area North Operable Unit 1-10* (DOE-ID 1999a) |
| September 2001 | *Record of Decision Amendment for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites Final Remedial Action* (DOE-ID 2001) |
| April 2003 | *Explanation of Significant Differences for the Record of Decision for the Test Area North Operable Unit 1-10* (DOE-ID 2003a) |
| February 2004 | *Record of Decision Amendment for the V-Tanks (TSF-09 and TSF-18) and Explanation of Significant Differences for the PM-2A Tanks (TSF-26) and TSF-06, Area 10 at Test Area North, Operable Unit 1-10* (DOE-ID 2004b) |
| January 2005 | *Explanation of Significant Differences for the Record of Decision for the Test Area North Operable Unit 1-10* (DOE-ID 2005) |
| **WAG 2** | |
| December 1991 | *Declaration for the Warm Waste Pond at the Test Reactor Area at the Idaho National Engineering Laboratory—Declaration of the Record of Decision* (DOE-ID 1991b) |
| December 1992 | *Record of Decision, Test Reactor Area Perched Water System, Operable Unit 2-12, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho* (DOE-ID 1992b) |
| March 1993 | *Explanation of Significant Differences for the Warm Waste Pond Sediments Record of Decision (ROD) at the Test Reactor Area at the Idaho National Engineering Laboratory* (Jensen and Montgomery 1993) |
| December 1997 | *Final Record of Decision, Test Reactor Area, Operable Unit 2-13* (DOE-ID 1997) |
| May 2000 | *Explanation of Significant Differences to the Record of Decision for Test Reactor Area Operable Unit 2-13* (DOE-ID 2000a) |
| **WAG 3** | |
| October 1999 | *Final Record of Decision Idaho Nuclear Technology and Engineering Center Operable Unit 3-13 Idaho National Engineering and Environmental Laboratory* (DOE-ID 1999b) |
| January 2004 | *Explanation of Significant Differences for the Final Record of Decision for the Idaho Nuclear Technology and Engineering Center, Operable Unit 3-13* (DOE-ID 2004c) |

Table 1-1. (continued).

| Date | Decision Document |
|---|---|
| **WAG 4** | |
| January 1992 | *Record of Decision – Central Facilities Area Motor Pool Pond, Operable Unit 4-11, Waste Area Group 4* (DOE-ID 1992c) |
| October 1995 | *Record of Decision Declaration for Central Facilities Area Landfills I, II, and III (Operable Unit 4-12) and No Action Sites (Operable Unit 4-03* (DOE-ID 1995b) |
| July 2000 | *Final Comprehensive Record of Decision for the Central Facilities Area Operable Unit 4-13* (DOE-ID 2000b) |
| February 2003 | *Explanation of Significant Differences to the Record of Decision for the Central Facilities Area, Operable Unit 4-13* (DOE-ID 2003b) |
| **WAG 5** | |
| September 1992 | *Power Burst Facility Record of Decision: Power Burst Facility Corrosive Waste Sump and Evaporation Pond, Operable Unit 5-13, Waste Area Group 5* (DOE-ID 1992d) |
| December 1992 | *Record of Decision: Auxiliary Reactor Area-I Chemical Evaporation Pond, Operable Unit 5-10* (DOE-ID 1992e). |
| May 1994 | *Explanation of Significant Difference: Power Burst Facility Corrosive Waste Sump and Evaporation Pond Record of Decision at the Idaho National Engineering Laboratory* (DOE-ID 1994a) |
| December 1994 | *Explanation of Significant Difference: Power Burst Facility Corrosive Waste Sump and Evaporation Pond Record of Decision at the Idaho National Engineering Laboratory* (DOE-ID 1994b) |
| January 1996 | *Record of Decision: Stationary Low Power Reactor-1 and Boiling Water Reactor Experimental-I Burial Grounds (Operable Units 5-05 and 6-01), and 10 No Action Sites (Operable Units 5-01, 5-03, 5-04, and 5-11)* (INEL 1996) |
| January 2000 | *Record of Decision: Power Burst Facility and Auxiliary Reactor Area* (DOE-ID 2000c) |
| August 2004 | *Explanation of Significant Differences for the Record of Decision for the Power Burst Facility and Auxiliary Reactor Area Operable Unit 5-12* (DOE-ID 2004d). |
| **WAG 6** | |
| January 1996 | *Record of Decision for Stationary Low-Power Reactor-1 and Boiling Water Reactor Experiment-I Burial Grounds (Operable Units 5-05 and 6-01) and 10 No Action Sites (Operable Units 5-01, 5-03, 5-04, and 5-11)* (INEL 1996) |
| November 2002 | *Record of Decision for Experimental Breeder Reactor-I/Boiling Water Reactor Experiment Area and Miscellaneous Sites (Operable Units 6-05 and 10-04)* (DOE-ID 2002a) |
| **WAG 7** | |
| October 1993 | *Record of Decision: Declaration for Pit 9 at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory* (DOE-ID 1993) |
| January 1994 | *Record of Decision Declaration for Pad A at the Radioactive Waste Management Complex Subsurface Disposal Area* (DOE-ID 1994c) |
| November 1994 | *Record of Decision Declaration for Organic Contamination in the Vadose Zone, Operable Unit 7-08, Idaho National Laboratory, Radioactive Waste Management Area, Subsurface Disposal Area* (DOE-ID 1994d) |

Table 1-1. (continued).

| Date | Decision Document |
|---|---|
| January 1995 | *Explanation of Significant Differences for the Pit 9 Interim Action Record of Decision at the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory* (DOE-ID 1995c) |
| September 1998 | *Explanation of Significant Differences for the Pit 9 Interim Action Record of Decision at the Radioactive Waste Management Complex at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 1998a) |
| **WAG 8** | |
| September 1994 | *Record of Decision Naval Reactors Facility Industrial Waste Ditch and Landfill Areas Operable Units 8-05, 8-06, and 8-07 Idaho National Engineering Laboratory Idaho Falls, Idaho* (DOE-ID 1994e) |
| September 1998 | *Final Record of Decision – Naval Reactors Facility Operable Unit 8-08 Idaho National Engineering and Environmental Laboratory Idaho Falls, Idaho* (DOE-ID 1998b) |
| July 2002 | *Explanation of Significant Difference from the Final Record of Decision for the Naval Reactors Facility – Operable Unit 8-08 Idaho National Engineering and Environmental Laboratory* (DOE-ID 2002b) |
| **WAG 9** | |
| September 1998 | *Final Record of Decision Argonne National Laboratory-West* (ANL-W 1998) |
| February 2000 | *Explanation of Significant Difference Argonne National Laboratory – West* (ANL-W 2000) |
| June 2004 | *Explanation of Significant Difference Argonne National Laboratory – West, Operable Unit 9-04* (ANL-W 2004) |
| **WAG 10** | |
| June 1992 | *Declaration of the Record of Decision for Ordnance Interim Action Operable Unit 10-05* (DOE-ID 1992f) |
| November 2002 | *Record of Decision for Experimental Breeder Reactor-I/Boiling Water Reactor Experiment Area and Miscellaneous Sites (Operable Units 6-05 and 10-04)* (DOE-ID 2002a) |

Table 1-2. Triggering action of five-year reviews at individual WAGs.

| Location | OU | Review Number | Triggering Action | Trigger Date |
|---|---|---|---|---|
| WAG 1 | 1-07B | First | Initiation of remedial action | September 2001 |
| | 1-10 | First | Initiation of remedial action | February 2000 |
| WAG 2 | 2-13 | Second | Signature of first five-year review report | September 2003 |
| WAG 3 | 3-13 | First | Initiation of remedial action | October 2000 |
| WAG 4 | 4-12 | Second | Signature of first five-year review report | November 2002 |
| WAG 5 | 5-05 | Second | Signature of first five-year review report | August 2001 |
| | 5-12 | First | Initiation of remedial action | June 2000 |
| WAG 6/10 | 6-01 | Second | Signature of first five-year review report | August 2001 |
| | 6-05 | First | Initiation of remedial action | April 2004 |
| | 10-04 | First | Initiation of remedial action | April 2004 |

Table 1-2. (continued).

| Location | OU | Review Number | Triggering Action | Trigger Date |
|---|---|---|---|---|
| WAG 7 | 7-08 | Second | Signature of first five-year review report | August 2003 |
| | 7-10 | First[a] | Initiation of remedial action | January 2004 |
| | 7-12 | Third | Signature of five-year review report | September 2003 |
| | | | Signature of two-year review report | December 1997 |
| WAG 8[b] | 8-08 | Two reviews completed | Not applicable | Not applicable |
| WAG 9 | 9-04 | First | Initiation of remedial action | May 1999 |

a. This is the first review of the remedy for OU 7-10. Periodic modifications to the remedy originally described in the 1993 OU 7-10 ROD (DOE-ID 1993) have occurred more often than five-year intervals, precluding the need to perform a review before now.
b. WAG 8 (the Naval Reactors Facility) is not under the jurisdiction of the DOE Idaho Operations Office and, therefore, is not addressed any further in this review.

Subsequent individual sections of this report are organized by WAG. Sitewide recommendations are presented after the individual WAG sections. Note that the Naval Reactors Facility, WAG 8, is not under the jurisdiction of the DOE Idaho Operations Office (DOE Idaho) and, therefore, is not subject to this review. Two five-year reviews have been performed at the Naval Reactors Facility and are available in the public record at INL.

## 1.1 Site Location

DOE Idaho manages the INL Site, which is located 32 mi west of Idaho Falls, Idaho. The INL Site occupies 890 $mi^2$ (Figure 1-1). Facilities at the site are primarily dedicated to environmental research, nuclear research and development, and waste management.

The northeastern portion of the eastern Snake River Plain, where the INL Site is situated , is a volcanic plateau composed of basalt flows intercalated with sand and silt interbeds. Below the INL Site lies part of the SRPA, which is the largest potable aquifer in Idaho. Overall, the SRPA is approximately 200 mi long, is approximately 50 mi wide, and covers an area of approximately 9,600 $mi^2$. The depth of the SRPA at the INL Site varies from approximately 200 ft in the northeastern corner to approximately 900 ft in the southeastern corner.

## 1.2 Changes to Exposure Pathways, Toxicity, and other Contaminant Characteristics

One of the questions asked during this review was, “Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?” Changes have occurred in some slope factors and toxicity values over the years since the RODs were signed, particularly the earlier RODs. Such changes have been evaluated as part of this five-year review.

Slope factors and risk-based values for nonradionuclides and radionuclides were examined. Toxicity values (slope factors and reference doses) were reviewed for changes. The slope factors and the reference doses were compared to the newest values available from the Integrated Risk Information System (IRIS), the Health Effects Assessment Summary Table (HEAST) (EPA 1995b), or other approved sources. Since the changes were minimal, there was no impact to the selected remedies. The scenario assumptions used in the human health risk assessment included both a current occupational worker and a

hypothetical future resident (100 years in the future). The exposure assumptions used for these scenarios remain the same.

Details of the changes to slope factors, IRIS, HEAST, and toxicity values and their implications for specific remedial action objectives are included in Appendix A of this document.

## 1.3 Section 1 References


40 CFR 300, 2002, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*, Office of the Federal Register, November 25, 2002.

42 USC § 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA/Superfund)," *United States Code,* December 11, 1980.

ANL-W, 1998, *Final Record of Decision Argonne National Laboratory-West*, W7500-000-ES-04, Idaho National Engineering and Environmental Laboratory, September 1998.

ANL-W, 2000, *Explanation of Significant Difference Argonne National Laboratory – West*, Document ID 10831, Idaho National Engineering and Environmental Laboratory, February 2000.

ANL-W, 2004, *Explanation of Significant Difference Argonne National Laboratory – West, Operable Unit 9-04*, Document ID 24867, Idaho National Engineering and Environmental Laboratory, June 2004.

DOE-ID, 1991a, *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory*, Administrative Docket No. 1088-06-29-120, U.S. Department of Energy Idaho Field Office; U.S. Environmental Protection Agency, Region 10; Idaho Department of Health and Welfare, December 4, 1991.

DOE-ID, 1991b, *Declaration for the Warm Waste Pond at the Test Reactor Area at the Idaho National Engineering Laboratory—Declaration of the Record of Decision*, Document ID 3320, Rev. 0, U.S. Department of Energy Idaho Field Office; U.S. Environmental Protection Agency, Region 10; Idaho Department of Health and Welfare, December 1991.

DOE-ID, 1992a, *Record of Decision (ROD) for Technical Support Facility (TSF) Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23)*, U.S. Department of Energy Idaho Field Office; U.S. Environmental Protection Agency, Region 10; Idaho Department of Health and Welfare, September 1992.

DOE-ID, 1992b, *Record of Decision, Test Reactor Area Perched Water System, Operable Unit 2-12, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho*, Document ID 5230, Rev. 0, U.S. Department of Energy Idaho Field Office; U.S. Environmental Protection Agency, Region 10; Idaho Department of Health and Welfare, December 1992.

DOE-ID, 1992c, *Record of Decision – Central Facilities Area Motor Pool Pond, Operable Unit 4-11, Waste Area Group 4*, Document ID 5242, Rev. 0, U.S. Department of Energy Idaho Field Office; U.S. Environmental Protection Agency, Region 10; Idaho Department of Health and Welfare, January 1992.

DOE-ID, 1992d, *Power Burst Facility Record of Decision: Power Burst Facility Corrosive Waste Sump and Evaporation Pond, Operable Unit 5-13, Waste Area Group 5*, Document ID 5204, U.S. Department of Energy Idaho Field Office; U.S. Environmental Protection Agency, Region 10; Idaho Department of Health and Welfare, September 1992.

DOE-ID, 1992e, *Record of Decision: Auxiliary Reactor Area-I Chemical Evaporation Pond, Operable Unit 5-10*, Document ID 5232, U.S. Department of Energy Idaho Field Office; U.S. Environmental Protection Agency, Region 10; Idaho Department of Health and Welfare, December 1992.

DOE-ID, 1992f, *Declaration of the Record of Decision for Ordnance Interim Action Operable Unit 10-05*, Document ID 5137, U.S. Department of Energy Idaho Field Office; U.S. Environmental Protection Agency, Region 10; Idaho Department of Health and Welfare, June 1992.

DOE-ID, 1993, *Record of Decision: Declaration for Pit 9 at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory*, Document ID 5569, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare, October 1993.

DOE-ID, 1994a, *Explanation of Significant Difference: Power Burst Facility Corrosive Waste Sump and Evaporation Pond Record of Decision at the Idaho National Engineering Laboratory*, Document ID 5702, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare, May 1994.

DOE-ID, 1994b, *Explanation of Significant Difference: Power Burst Facility Corrosive Waste Sump and Evaporation Pond Record of Decision at the Idaho National Engineering Laboratory*, Document ID 5814, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare, December 1994.

DOE-ID, 1994c, *Record of Decision Declaration for Pad A at the Radioactive Waste Management Complex Subsurface Disposal Area*, U.S. Department of Energy, U.S. Environmental Protection Agency, Idaho Department of Health and Welfare, January 1994.

DOE-ID, 1994d, *Record of Decision Declaration for Organic Contamination in the Vadose Zone, Operable Unit 7-08, Idaho National Laboratory, Radioactive Waste Management Area, Subsurface Disposal Area*, Document ID 5761, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency; Idaho Department of Health and Welfare, November 1994.

DOE-ID, 1994e, *Record of Decision Naval Reactors Facility Industrial Waste Ditch and Landfill Areas Operable Units 8-05, 8-06, and 8-07 Idaho National Engineering Laboratory Idaho Falls, Idaho*, Document ID 5781, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency; Idaho Department of Health and Welfare, September 1994.

DOE-ID, 1995a, *Record of Decision for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites Final Remedial Action,* DOE/ID-10139, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare, August 1995.

DOE-ID, 1995b, *Record of Decision Declaration for Central Facilities Area Landfills I, II, and III (Operable Unit 4-12) and No Action Sites (Operable Unit 4-03)*, Document ID AR5.1-10146, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare, October 1995.

DOE-ID, 1995c, *Explanation of Significant Differences for the Pit 9 Interim Action Record of Decision at the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory*, Document ID 5862, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare, January 1995.

DOE-ID, 1997, *Final Record of Decision, Test Reactor Area, Operable Unit 2-13*, DOE/ID-10586, Rev. 0, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare, December 1997.

DOE-ID, 1998a, *Explanation of Significant Differences for the Pit 9 Interim Action Record of Decision at the Radioactive Waste Management Complex at the Idaho National Engineering and Environmental Laboratory*, Document ID 10537, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare, September 1998.

DOE-ID, 1998b, *Final Record of Decision – Naval Reactors Facility Operable Unit 8-08 Idaho National Engineering and Environmental Laboratory Idaho Falls, Idaho*, Document ID 10544, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; and Idaho Department of Health and Welfare, September 1998.

DOE-ID, 1999a, *Final Record of Decision for Test Area North Operable Unit 1-10*, DOE/ID-10682, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; Idaho Department of Health and Welfare, October 1999.

DOE-ID, 1999b, *Final Record of Decision Idaho Nuclear Technology and Engineering Center Operable Unit 3-13 Idaho National Engineering and Environmental Laboratory*, DOE/ID-10660, Rev. 0, U.S. Department of Energy Idaho Operations Office; U.S. Environmental Protection Agency, Region 10; Idaho Department of Health and Welfare, October 1999.

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# 2. SITEWIDE INSTITUTIONAL CONTROLS, OPERATIONS, AND MAINTENANCE

## 2.1 Land Use

The U.S. Atomic Energy Commission (now the U.S. Department of Energy [DOE]) founded the Idaho National Laboratory (INL) in 1949. At that time, it was known as the National Reactor Testing Station and was established to build, test, and operate nuclear reactors, fuel reprocessing plants, and support facilities with maximum safety and isolation. In 1974, the area was designated as the Idaho National Engineering Laboratory to reflect the broad scope of engineering activities conducted there. The name was changed to the Idaho National Engineering and Environmental Laboratory in 1997 to reflect its redirected mission, which included environmental research. In 2005, the name was changed to the Idaho National Laboratory.

The Bureau of Land Management manages the surrounding areas for multipurpose use. Communities nearest the INL Site are Atomic City (south), Arco (west), Butte City (west), Howe (northwest), Mud Lake (northeast), and Terreton (northeast). In the counties surrounding the INL Site, approximately 45% of the land is agricultural, 45% is open land, and 10% is urban.

A total of 90 mi of paved highways pass through the INL Site and are used by the public. However, security personnel and fences strictly control public access to facilities at the INL Site.

To facilitate decisions about environmental restoration activities at the INL Site, the DOE Idaho Operations Office conducted analyses, starting in 1992, to project reasonable INL land use scenarios for the next 100 years. The effort was completed in 1995. The methodology for generating the scenarios included reviewing existing DOE plans, policy statements, and mission statements pertaining to the site; reviewing surrounding land use characteristics and county development policies; soliciting input from local, county, state, and federal planners, policy specialists, environmental professionals, and elected officials; and reviewing constraints that could influence future land use at the INL Site.

These analyses resulted in the development of specific issues, assumptions, and constraints that guided the generation of facility and land use scenarios for the next 100 years, as published in the *Long-Term Land Use Future Scenarios for the Idaho National Engineering Laboratory* (DOE-ID 1995). In general, the scenarios projected (a) no change to the present INL boundaries within the 100-year period and (b) future industrial development during the next 100 years (most likely concentrated in the central portion of the INL Site) and within existing major facility areas. The document also indicated that future land use predictions would become increasingly uncertain beyond 100 years. In general, records of decision discussed in this review have remedies whose risk-management decisions were based on remediation of contaminated areas to a condition suitable for future residential use after a 100-year period elapses.

## 2.2 Institutional Controls

Institutional controls are measures taken to limit or prohibit activities that might interfere with the integrity of an interim or cleanup action or result in human exposure to hazardous substances at a site. Such measures are required in order to ensure both the continued protection of human health and the environment and the integrity of an interim or cleanup action. Institutional controls are intended to supplement engineering controls and might be a necessary component of the completed remedy. Institutional controls may be used during the remedial investigation/feasibility study, during implementation of the remedial action, and, when necessary, as a component of the completed remedy.

Institutional controls are generally required when residual concentrations of hazardous substances remain and preclude releasing an area for unrestricted land use, or when the the U.S. Environmental Protection Agency (EPA), the DOE, and the Idaho Department of Environmental Quality (known throughout the rest of this document as "the agencies") determine that such controls are needed to protect human health or the environment.

The institutional controls at the INL Site are based on guidance in the May 3, 1999, EPA "Region 10 Final Policy on the Use of ICs at Federal Facilities" (EPA 1999); the September 29, 2000, EPA guidance "Institutional Controls: A Site Manager's Guide to Identifying, Evaluating, and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups" (EPA 2000); and the April 9, 2003, DOE policy "Use of Institutional Controls" (DOE P 454.1).

With the exception of Waste Area Groups (WAGs) 8 and 9, institutionally controlled sites are assessed and maintained on an INL sitewide basis. These activities are conducted in accordance with the requirements specified in decision documents and compiled in the *Idaho National Engineering and Environmental Laboratory Sitewide Institutional Controls Plan* (DOE-ID 2004a) by utilizing internal procedures, Federal Register notices, informational announcements, and contracts consistent with applicable laws, regulations, agreements, and consent orders. Institutional control includes implementing administrative and access controls, evaluating those controls, and preparing status reports summarizing the evaluation.

Consolidation of the institutional controls process at the INL Site has resulted in consistent implementation, maintenance, and inspection of institutional controls. The most recent assessment is reported in the *INEEL Sitewide Institutional Controls Annual Report – FY 2004* (DOE-ID 2004b). All institutional controls were found to be functioning as intended. Information about Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites and institutional controls at the INL Site is available publicly on the Web at http://cflup.inel.gov as part of the *Idaho National Engineering and Environmental Laboratory Comprehensive Facilities and Land Use Plan* (DOE-ID 2005).

Remedial activities at the INL Site have advanced significantly during the five years covered by this review. Several CERCLA sites have been remediated to the point that hazards no longer remain there; however, the remedial action reports or other closure documentation have not been completed. Those sites are discussed in the individual sections of this document, and eliminating them as institutionally controlled sites upon completion of the proper closure documentation is recommended. The sites will be designated as no-action sites, warning signs and other institutional controls will be removed, and the sites will no longer be listed in the current version of the CERCLA site listings.

CERCLA sites with hazards that preclude release for unrestricted residential use will retain institutional controls and will be assessed, maintained, and reported on annually. New sites that are identified as having unacceptable risk and determined by the agencies to be action or no-further-action sites have institutional controls and are included in the annual assessment, maintenance, and reporting program.

## 2.3 Operations and Maintenance

Operations and maintenance activities are measures taken to ensure that selected remedies remain protective of human health and the environment after remedial actions have been completed. In some cases, however, operations and maintenance activities have been specified for sites during the pre-remediation phase.

Operations and maintenance activities required by the WAG-specific operations and maintenance plans have been incorporated into the *INEEL Sitewide Operations and Maintenance Plan for CERCLA Response Actions* (DOE-ID 2004c). With the exception of WAGs 8 and 9, operations and maintenance activities will be conducted on a sitewide basis at the INL Site beginning in 2005. Those activities are conducted in accordance with the requirements specified in the decision documents, and results of site inspections will be compiled into a single summary report.

## 2.4 Section 2 References


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# 3. SITEWIDE FIVE-YEAR REVIEW PROCESS

## 3.1 Administrative Components

The U.S. Department of Energy Idaho Operations Office (DOE Idaho) is the lead agency for conducting and reporting this sitewide five-year review of the Idaho National Laboratory site. The U.S. Environmental Protection Agency (EPA) retains the final authority for evaluating the completeness of the review. Members of the five-year review team consisted of representatives from DOE Idaho, the EPA, and the Idaho Department of Environmental Quality as well as contractor personnel. A conference call held on October 27, 2004, among the parties mentioned above initiated the discussion regarding the schedule and content of this five-year review. The Shoshone-Bannock Tribes were notified of this five-year review in a meeting held on November 23, 2004.

## 3.2 Community Involvement

INL stakeholders and the public were notified of this five-year review, and their input was requested. Responses from the community were received and immediately entered into the INL Site Administrative Record database. In June 2005, notifications were made in the following newspapers that the results of the five-year review were being compiled into this report:

- *Arco Advertiser* (Arco, Idaho)
- *Idaho State Journal* (Pocatello, Idaho)
- *The Idaho Statesman* (Boise, Idaho)
- *Idaho Unido* (Pocatello, Idaho)
- *Moscow-Pullman Daily News* (Moscow, Idaho, and Pullman, Washington)
- *The Post Register* (Idaho Falls, Idaho)
- *Sho-Ban News* (Fort Hall Reservation)
- *The Times News* (Twin Falls, Idaho).

# 4. WASTE AREA GROUP 1 (TEST AREA NORTH)

Test Area North (TAN) was established in the early 1950s by the U.S. Air Force and the Atomic Energy Commission (now the U.S. Department of Energy [DOE]) to support research into nuclear-powered aircraft. Upon termination of that research in 1961, the TAN facilities were converted to support a variety of other DOE research projects.

From 1962 through the 1970s, TAN supported reactor safety testing and behavior studies at the Loss-of-Fluid Test Facility, the Initial Engine Test (IET), and the Water Reactor Research Test Facility (WRRTF). Beginning in 1980, TAN was used to conduct work with material from the 1979 Three-Mile Island reactor accident. The Technical Support Facility (TSF) at TAN supports energy research and defense programs. Specialized facilities are also maintained at TSF for technical engineering and remote radioactive materials-handling programs.

Over the years, some of the projects at TAN have resulted in releases of contamination to the environment. To facilitate cleanup of the contamination, TAN was designated as Waste Area Group (WAG) 1 under a federal facility agreement and consent order (FFA/CO) (DOE-ID 1991). To better manage the cleanup, WAG 1 was divided into smaller operable units (OUs). Final remedial actions are, therefore, being implemented under OUs 1-07B (which consists of TAN groundwater contamination) and OU 1-10 (which consists of the remainder of TAN).

## 4.1 Operable Unit 1-07B (TAN Groundwater Contamination)

From about 1953 to 1972, liquid wastes generated at TAN were disposed of in the TSF injection well (Site TSF-05), resulting in dispersion of contaminants into the Snake River Plain Aquifer (SRPA) beneath TAN. The wastes consisted mainly of industrial and sanitary wastewater but also included organic, inorganic, and low-level radioactive wastewater. As a result of the waste disposed of at Site TSF-05, contaminated sludge material containing entrapped contaminants, primarily trichloroethene (TCE), are present in the non-aqueous phase liquid and/or sorbed phase. As groundwater flows through the contaminated sludge material, entrapped contaminants dissolve into the aqueous phase, which has resulted in a contaminated groundwater plume emanating from the TSF-05 injection well.

Groundwater containing TCE at concentrations greater than 5 μg/L in the area of Site TSF-05 has been designated as OU 1-07B, and final remedial actions for TSF-05 and the surrounding groundwater contamination (Site TSF-23) are implemented under OU 1-07B. A complete list of the OU 1-07B contaminants of concern (COCs) is provided in Table 4-1.

This Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC § 9601 et seq.) remedial action is proceeding in accordance with the OU 1-07B record of decision (ROD) (DOE-ID 1995) and the ROD amendment (DOE-ID 2001a). In addition to Sites TSF-05 and TSF-23, the OU 1-07B ROD addressed 31 potential release sites at TAN that were designated as no-action sites.

The boundary of the contaminant plume was defined in the 1995 ROD (DOE-ID 1995) based on TCE concentrations, because TCE has the largest distribution of the COCs at OU 1-07B. In the 2001 ROD amendment (DOE-ID 2001a), OU 1-07B was divided into three zones identified as the “hot spot,” the “medial zone,” and the “distal zone.” The hot spot was identified as the area immediately around the injection well, where concentrations of TCE exceed 20,000 parts per billion (ppb). The medial zone was the portion of the plume where concentrations of TCE are between 1,000 and 20,000 ppb. The distal zone

was the remainder of the plume where TCE concentrations are between 5 and 1,000 ppb. A graphical depiction of the groundwater plume and zones is presented in Figure 4-1. Additional information on the geology, the hydrology, and the nature and extent of contamination is provided in the 1995 ROD (DOE-ID 1995) and can be found in the administrative record for OU 1-07B. Table 4-2 provides a chronology of significant events at OU 1-07B.

Table 4-1. COCs at OU 1-07B.

| COC | Maximum Concentrations[a] | Cleanup Goal[b] |
|---|---|---|
| Volatile Organic Compounds | | |
| Trichloroethene (TCE) | 12,000 – 32,000 ppb | 5 ppb[c] |
| Tetrachloroethene (PCE) | 110 ppb | 5 ppb[c] |
| *cis*-1,2-Dichloroethene (DCE) | 3,200 – 7,500 ppb | 70 ppb[c] |
| *trans*-1,2-DCE | 1,300 – 3,900 ppb | 100 ppb[c] |
| Radionuclides | | |
| Tritium | 14,900 – 15,300 pCi/L[d] | 20,000 pCi/L |
| Sr-90 | 530 – 1,880 pCi/L | 8 pCi/L |
| Cs-137 | 1,600 – 2,150 pCi/L | 119 pCi/L[e] |
| U-234 | 5.2 – 7.7 pCi/L[d] | 27 pCi/L[f] |

a. The concentration range is taken from measured concentrations at the TSF-05 injection well. Source: *Fiscal Year 1999 Groundwater Monitoring Report, Test Area North, Operable Unit 1-07B* (INEEL 2000).
b. Cleanup goals are based on the federal drinking water standards. The cumulative risk of contaminants must be less than $1 \times 10^{-4}$, and the hazard index must be less than 1.
c. Parts per billion (ppb) is a weight-to-weight ratio that is equivalent to micrograms per liter (μg/L) in water.
d. Maximum concentrations of tritium and U-234 are below federal drinking water standards, and baseline risk calculations indicate a cancer risk of $3 \times 10^{-6}$. While this risk is smaller than $1 \times 10^{-4}$, both tritium and U-234 are included as COCs as a comprehensive plume management strategy.
e. The maximum contaminant level for Cs-137 is derived from a limit of 4 mrem/yr cumulative dose equivalent to the public, assuming a lifetime intake of 2 L/day of water.
f. The federal drinking water standard for U-234 is for the U-234, -235, and -238 series.

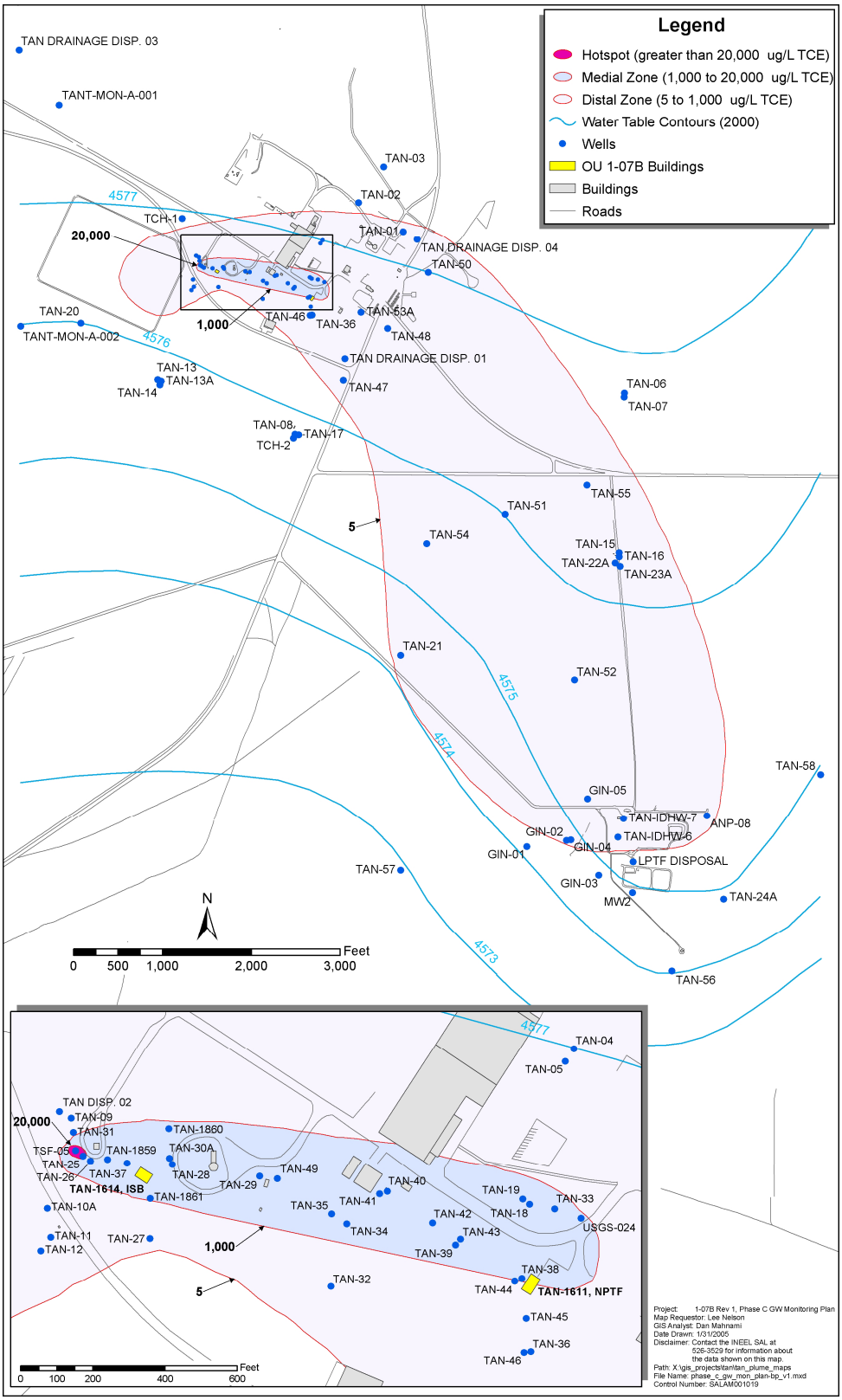



Figure 4-1. Facilities and well locations at TAN. OU 1-07B consists of the TSF-05 injection well and the TSF-23 contaminant plume underlying TAN. TCE concentration zones were defined in the 2001 ROD amendment (DOE-ID 2001a).

Table 4-2. Chronology of OU 1-07B events.

| Event | Date |
|---|---|
| TAN consists of several experimental and support facilities used to research and develop nuclear reactor performance and safety. Liquid wastes that were generated were being discharged to the TSF-05 injection well to dispose of them. | 1953–1972 |
| Low levels of TCE and PCE were detected in the wells used to supply drinking water to workers at TAN. The TSF-05 injection well was identified as the source of the groundwater contamination. | 1987 |
| The Idaho National Engineering Laboratory (now known as the Idaho National Laboratory) was listed on the National Priorities List (54 Federal Register [FR] 29820). | November 1989 |
| Sludge was removed from the TSF-05 injection well. | 1990 |
| The FFA/CO (DOE-ID 1991) was signed. | December 1991 |
| The agencies began an interim action designated as OU 1-07A, as documented in the *Interim Action Record of Decision (ROD) for Technical Support Facility (TSF) Injection Well and Surrounding Groundwater Contamination* (INEL 1992). | 1992 |
| The Groundwater Treatment Facility began operations to extract and treat contaminated groundwater in the vicinity of the TSF-05 injection well. | February 1994 |
| The remedial investigation/feasibility study (RI/FS) for OU 1-07B was completed (EG&G 1994). | 1994 |
| Based on the RI/FS, the *Proposed Plan for Operable Unit 1-07B, Final Remedial Action at the TSF Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23)* (DOE-ID, EPA, and DEQ 1994) was published. | May 1994 |
| The agencies' agreement to clean up OU 1-07B was documented in a ROD signed in August 1995 (DOE-ID 1995). The 1995 ROD directed that pump-and-treat technology be used as the default remedy to restore the SRPA and that treatability studies be conducted concurrently to identify more efficient methods that may be used during the final cleanup implementation. | August 1995 |
| OU 1-07B Phase A, which was defined as a transition from the OU 1-07A interim action to the OU 1-07B final action, was completed. Under OU 1-07B Phase B, planning for the treatability studies was completed, and source containment using pump-and-treat began. | September 1995 |
| The agencies published an explanation of significant differences (INEEL 1997) that documented changes to the 1995 ROD in several areas, including contaminant area definitions (hot spot, medial zone, and distal zone), the treatability studies schedule, and the waste management requirements. Early implementation of OU 1-07B Phase C, the final remedy implementation, began for the medial zone. | November 1997 |
| The treatability studies were completed, and the results were summarized in a field demonstration report (DOE-ID 2000a). Results of the treatability studies showed that two of the technologies investigated, in situ bioremdiation (ISB, using sodium lactate) and monitored natural attenuation (MNA), would better meet the balancing criteria than pump-and-treat technology for remediation of the hot spot and the distal zone, respectively. | 1999 |
| The New Pump and Treat Facility (NPTF) remedial design (DOE-ID 2000b) was approved by the agencies. | March 2000 |
| The ROD amendment proposed plan (DOE-ID, EPA, and DEQ 2000) was prepared, recommending final remedy changes for the hot spot and distal zone of the contaminated plume. | 2000 |
| Construction of the NPTF in the medial zone was completed. | January 2001 |
| The ROD amendment (DOE-ID 2001a) was signed, identifying ISB and MNA as the final remedies to be used for the hot spot and distal zone. | September 2001 |
| Routine NPTF operations began. | October 2001 |
| The remedial design/remedial action scope of work associated with the ROD amendment was completed. | December 2001 |

Table 4-2. (continued).

| Event | Date |
|---|---|
| The ISB remedial action work plan was approved (DOE-ID 2002a). | December 2002 |
| The MNA remedial action work plan was approved (DOE-ID 2003a). | June 2003 |
| ISB facility construction and the final inspection with the agencies were completed. ISB operations began. | October 2003 |
| The MNA pre-final/final inspection was completed, and MNA operations began. | October 2003 |
| The alternate electron donor optimization began in order to evaluate the use of whey powder for long-term operations and to ascertain whether whey powder, compared to sodium lactate, will improve system performance and decrease the cost of ISB. Sodium lactate was used for all previous ISB activities. | March 2004 |
| The medial zone rebound test began in order to evaluate the effectiveness of the NPTF. The NPTF was shutdown on March 1, 2005, and the rebound test is anticipated to last approximately two years. | March 2005 |

### 4.1.1 Remedial Actions

***4.1.1.1 Remedy Selection.*** The final remedy for OU 1-07B integrates separate technologies to address the three zones of the plume: (1) in situ bioremediation (ISB) for hot spot restoration, (2) pump-and-treat technology for the medial zone, and (3) monitored natural attenuation (MNA) for distal zone restoration. These technologies comprise a comprehensive approach to restoring the contaminant plume. This remedy includes groundwater monitoring throughout the plume, with analysis of samples to ascertain the progress of the remedy and monitor the plume boundary.

The remedy also prevents current and future exposure of workers, the public, and the environment to contaminated groundwater at TSF-05, because the remedy permanently reduces the toxicity, mobility, and volume of contamination at OU 1-07B. Institutional controls (both engineered and administrative) are in place to protect current and future users from health risks associated with groundwater contamination and will be modified, as required, to maintain a conservative buffer zone around the contaminant plume. Descriptions of the remedial components for restoration of the OU 1-07B hot spot, medial zone, and distal zone of the contaminant plume are stated in Figure 4-2 and discussed in the following paragraphs.

**Hot Spot**—ISB, used to remediate the hot spot, promotes bacterial growth by supplying essential nutrients to indigenous bacteria that are able to break down contaminants within the SRPA. An amendment, such as sodium lactate or whey, is injected into the secondary source area through the TSF-05 injection well or through other injection wells in the immediate vicinity. Amendment injections increase the number of bacteria, thereby increasing the rate at which the volatile organic compounds (VOCs) break down into harmless compounds. The amendment supply is distributed as needed. The treatment system has operated since 1999.

**Medial Zone**—Pump-and-treat, used to remediate the medial zone, involves extraction of contaminated groundwater, treatment through air strippers, and injection of the treated groundwater back into the SRPA. Air stripping is a process that brings clean air into contact with contaminated liquid, allowing the contaminants to pass from the liquid into the air, where they quickly evaporate. In accordance with the original remedy selected in the 1995 ROD (DOE-ID 1995), construction of the New Pump and Treat Facility (NPTF) in the medial zone was completed in January 2001. Routine NPTF operations began on October 1, 2001. The agencies approved a medial zone rebound test to evaluate the effectiveness of the NPTF (ICP 2004a). The NPTF was shutdown on March 1, 2005, and the rebound test is expected to continue for approximately two years.

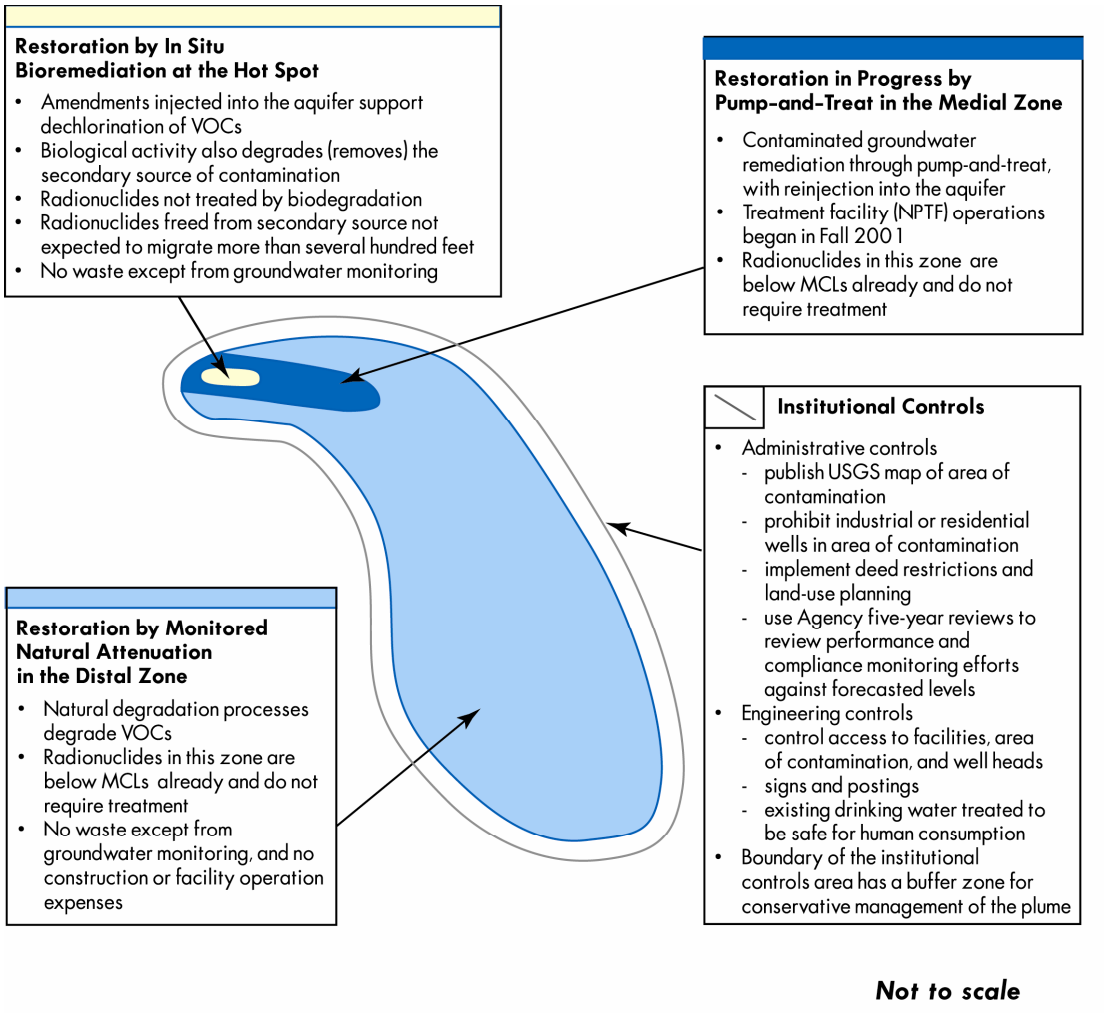



Figure 4-2. Conceptual illustration of the components of the amended OU 1-07B remedy (from the 2001 ROD amendment [DOE-ID 2001a]).

**Distal Zone**—Natural attenuation encompasses the physical, chemical, and biological processes that act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in groundwater. MNA, used to remediate the distal zone, includes groundwater monitoring to compare actual measured natural degradation rates to predicted degradation rates.

Contingencies identified for the medial and distal zones under the remedy include the following:

- For the medial zone, monitoring wells located upgradient of the NPTF (TAN-25, -28, -29, -30A, -37, and TSF-05) are monitored on a routine basis to ensure that concentrations of radionuclides in the groundwater remain low. Well locations are shown on Figure 4-1. If monitoring indicates that the concentration of radionuclides in the NPTF effluent would exceed maximum contaminant levels (MCLs), the Air Stripper Treatment Unit located between the hot spot and the NPTF will be restarted and operated to prevent radionuclides from traveling downgradient to the NPTF. The NPTF is not currently operating due to the medial zone rebound test.

- For the distal zone, if the agencies determine that MNA will not restore the distal zone of the plume within the restoration timeframe, pump-and-treat units will be designed, constructed, and operated in the distal zone to remediate the plume. This contingency remedy will also be invoked if the required monitoring necessary for MNA is not performed.

The remedial design/remedial action scope of work (DOE-ID 2001b) defines the scope, schedule, and budget for implementation of the OU 1-07B final remedial action, as required by CERCLA (42 USC § 9601 et seq.) and the FFA/CO (DOE-ID 1991) and in accordance with the ROD amendment (DOE-ID 2001a).

***4.1.1.2 Remedial Action Objectives.*** Changes and results documented in an explanation of significant differences (ESD) (INEEL 1997) and the field demonstration report (DOE-ID 2000a) prompted a refinement of the remedial action objectives (RAOs) identified in the 1995 ROD. The agencies agreed to follow final RAOs for the entire contaminant plume in the 2001 ROD amendment. The RAOs are as follows:

- Restore the contaminated aquifer groundwater by 2095 (100 years from the signature of the 1995 ROD) by reducing all COCs to below MCLs and a $1 \times 10^{-4}$ total cumulative carcinogenic risk-based level for future residential groundwater use and, for noncarcinogens, until the cumulative hazard index is less than 1.
- For aboveground treatment processes in which treated effluent will be reinjected into the aquifer, reduce the concentrations of VOCs to below MCLs and a $1 \times 10^{-5}$ total risk-based level.
- Implement institutional controls to protect current and future users from health risks associated with (1) ingestion or inhalation of, or dermal contact with, contaminants in concentrations greater than the MCLs, (2) contaminants with greater than a $1 \times 10^{-4}$ cumulative carcinogenic risk-based concentration, or (3) a cumulative hazard index of greater than 1, whichever is more restrictive. The institutional controls shall be maintained until concentrations of all COCs are below MCLs and until the cumulative carcinogenic risk-based level is less than $1 \times 10^{-4}$ and, for noncarcinogens, until the cumulative hazard index is less than 1. Institutional controls shall include access restrictions and warning signs.

***4.1.1.3 Remedy Implementation.*** Implementation of the final remedy started in October 2001, when the NPTF began routine operations in the medial zone. In October 2003, the hot spot remedy (i.e., ISB) and the distal zone remedy (i.e., MNA) became operational; however, actions supporting these remedies have been implemented since 1999 through the treatability studies and post-treatability study activities.

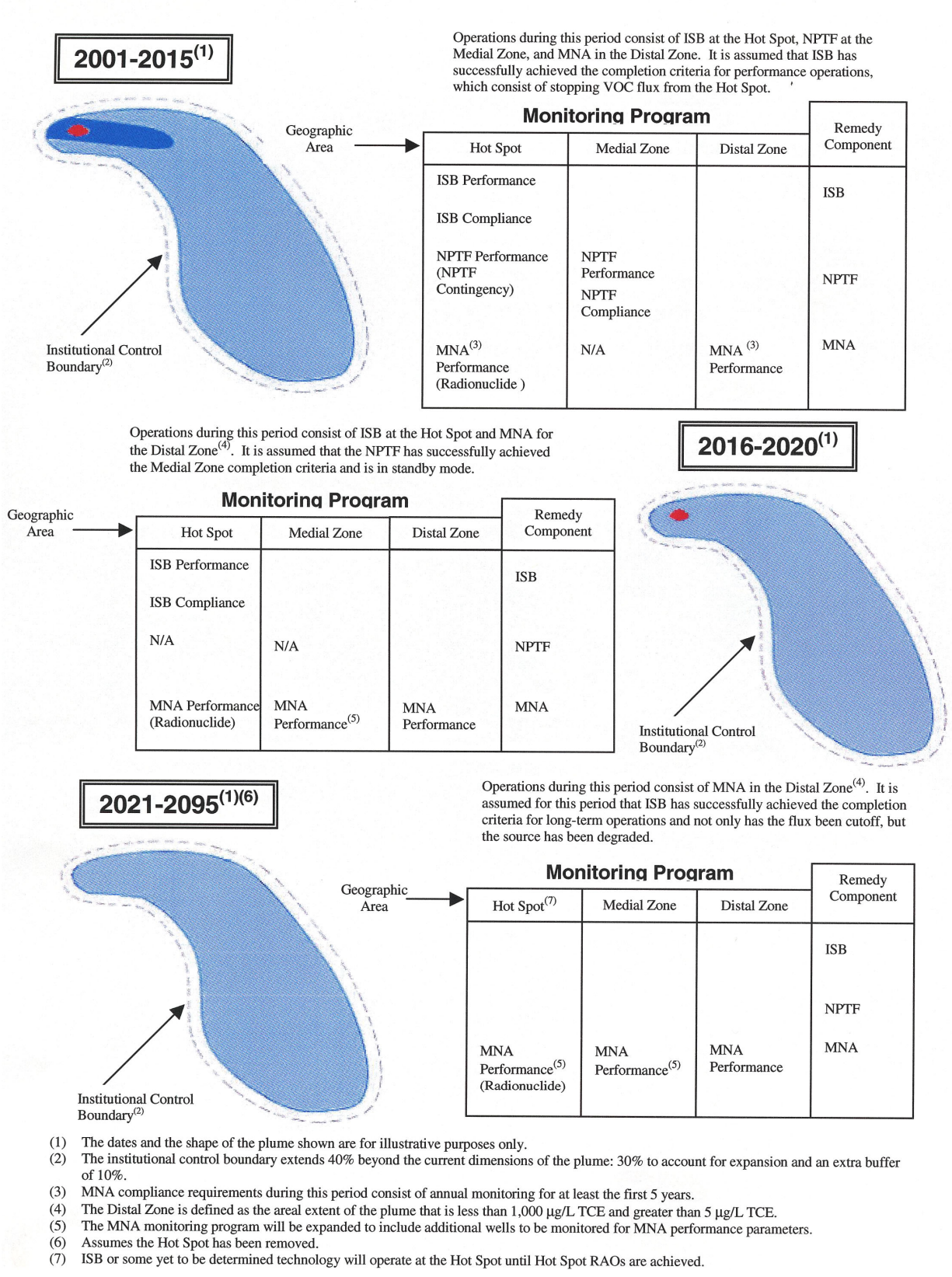
The success of the overall remedial action depends on all remedial components performing as planned in order to achieve remediation goals. The monitoring program for each remedial component provides data to evaluate the performance of each component as well as the overall remedial action. As remedial components are completed, a comprehensive monitoring program (details in Table 4-3) will continue to provide data necessary to evaluate attainment of all RAOs. Figure 4-3 illustrates the expected interaction of various remedy components' monitoring programs over the life of the remedy.

### 4.1.2 Data Evaluation

The following subsections summarize data collected to evaluate the performance of the three remedial components

Table 4-3. Monitoring crosswalk table for the OU 1-07B remedial action.

| Monitoring Zone | Monitoring Type | Sample Parameter | Decision/Evaluation Objective | Goal | Sample Program | Basis Document |
|---|---|---|---|---|---|---|
| Hot Spot | ISB performance | ISB performance parameters<br>• VOCs<br>• Tritium<br>• Ethene, ethane, methane, redox, electron donor, bioactivity, and nutrient | Trending<br>• Donor distribution<br>• Source degradation<br>• Flux<br>• New donor | Optimize operation to meet compliance objectives/requirements. | ISB | ISB work plan |
| | ISB compliance | VOCs (TAN-28 and -30A) | VOCs below MCLs for 1 year | Achieve reduction of downgradient flux to below MCLs. | ISB | ISB work plan |
| | | VOCs (TAN-1860 and -1861) | VOCs below MCLs for 1 year | Achieve reduction of cross-gradient flux to below MCLs. | | |
| | ISB completion compliance | All VOCs (wells to be determined) | Hot spot completion | Determine ISB RAOs have been met in the hot spot. | ISB | ISB remedial action report |
| | NPTF performance | VOCs plus radionuclides (strontium and cesium) (TAN-28, -29, and -30A) | Upgradient source | Conduct NPTF contingency evaluation monitoring. | NPTF | NPTF work plan |
| | MNA performance | Radionuclides (strontium and cesium) (TAN-25, -28, -29, -30A, -37, and TSF-05) | Upgradient radionuclide monitoring (hot spot) | Monitor/evaluate hot spot radionuclide degradation and migration. | MNA | MNA work plan |
| Medial Zone | NPTF performance | Drawdown | Facility operations | Capture the plume. | NPTF | NPTF work plan |
| | NPTF compliance | Facility influent/effluent VOCs and strontium | Facility operations | Stay within influent and effluent specifications. | NPTF | NPTF work plan |
| | | Air emissions | Facility operations | Stay within effluent specifications. | | |
| | | Operations uptime | Facility operations | Maintain 90% uptime. | | |
| | | Extraction flow rate | Facility operations | Operate within specified flow rate. | | |
| | NPTF completion compliance | All COCs (wells to be determined) | Medial zone completion | Determine that NPTF RAOs have been or can be met in the medial zone. | NPTF | NPTF work plan |
| Distal Zone | MNA performance | MNA performance parameters:<br>• VOCs<br>• Tritium | Breakthrough curves<br>Plume expansion<br>Degradation rate | Trends are toward achievement of RAOs. | MNA | MNA work plan |
| | MNA compliance | MNA performance parameters for five years | MNA performance parameters | Annual sampling is a requirement for at least the first five years. | MNA | MNA work plan |
| | MNA completion compliance | All COCs | Remedial action completion | Determine that RAOs have been met throughout the plume. | MNA | MNA remedial action report |




(1) The dates and the shape of the plume shown are for illustrative purposes only.
(2) The institutional control boundary extends 40% beyond the current dimensions of the plume: 30% to account for expansion and an extra buffer of 10%.
(3) MNA compliance requirements during this period consist of annual monitoring for at least the first 5 years.
(4) The Distal Zone is defined as the areal extent of the plume that is less than 1,000 µg/L TCE and greater than 5 µg/L TCE.
(5) The MNA monitoring program will be expanded to include additional wells to be monitored for MNA performance parameters.
(6) Assumes the Hot Spot has been removed.
(7) ISB or some yet to be determined technology will operate at the Hot Spot until Hot Spot RAOs are achieved.

Figure 4-3. Generalized monitoring program operations throughout the remedial action timeframe.

***4.1.2.1 Hot Spot.*** ISB is currently being implemented in the hot spot. Periodic electron donor injections are performed to stimulate increased biological activity, which results in enhanced biodegradation of VOCs through anaerobic reductive dechlorination. Starting with the treatability studies in 1999 through October 2003, sodium lactate was injected into TSF-05 on a weekly to bimonthly frequency. Modifications have been made to the injection strategy in order to optimize ISB performance. Beginning in November 2003, sodium lactate was injected into TSF-05 and TAN-1859 (a downgradient well) on an alternating monthly basis. Following these alternating injections, a field optimization to evaluate ISB effectiveness using whey powder in comparison to sodium lactate began in March 2004 and continued through June 2005. Results of this field optimization will be documented in a future ISB annual report. In general, good conditions for anaerobic reductive dechlorination are being maintained in the hot spot.

Multiple analytical parameters from 17 monitoring locations (TSF-05A and -05B and TAN-10A, -25, -26, -27, -28, -29, -30A, -31, -37A, -37B, -37C, -D2, -1859, -1860, and -1861) are evaluated to ascertain the effectiveness and consider operational changes to optimize anaerobic reductive dechlorination. See Figure 4-1 for the location of monitoring wells. The long-term goal is to achieve hot spot source degradation with intermediary goals of reducing flux of VOCs from the hot spot in both the downgradient and cross-gradient directions. Groundwater-monitoring results are used to measure the progress of the remedy goals through evaluation of COC concentration trends in combination with the other analytical parameters. As one part of the overall remedial picture, declining TCE trends in five hot-spot and downgradient wells are shown in Figure 4-4. The purpose of current ISB operations is to optimize operations in order to work toward meeting the ISB compliance objectives stated in Table 4-3. Those objectives include reduction of flux to downgradient wells (TAN-28 and -30A) and cross-gradient wells (TAN-1860 and -1861). Additional data and evaluation of ISB effectiveness are documented in ISB annual reports (INEEL 2002a; INEEL 2003a; Armstrong et al. 2004; Macbeth et al. 2005).

***4.1.2.2 Medial Zone.*** The NPTF was constructed to remediate the medial zone of the plume through extraction of contaminated groundwater, treatment through air strippers, and reinjection of the treated water. Performance and compliance monitoring is completed to demonstrate that the NPTF is operating as intended. This monitoring includes contaminant concentration trends and the associated calculated carcinogenic risk of water treated through the NPTF and reinjected into the SRPA, operational uptime, drawdown measurements, air emissions, and contaminant concentrations in groundwater in the medial zone.

The risk calculation methodology for water treated through the NPTF is documented in Appendix C of the *New Pump and Treat Facility Operations and Maintenance Plan for Test Area North Final Groundwater Remediation, Operable Unit 1-07B* (DOE-ID 2003b). Only contaminants with analytical values above the applicable method detection limit (2 μg/L for PCE, TCE, *cis*-DCE, and *trans*-DCE; 1 μg/L for vinyl chloride) are included in the cumulative risk calculation. The concentration of contaminants in treated water since the beginning of operations has been less than the applicable method detection limit. As a result, the concentration of contaminants present in treated water is less than the MCL, and the calculated carcinogenic risk of treated water is zero.

The operational uptime goal for the NPTF is 90%. Uptime is based on the total operational uptime over a specific period and is calculated over a rolling 12-month period. Since the beginning of long-term operations in October 2001, the uptime has always exceeded 90%. The uptime was 98.4% from the beginning of operations to September 30, 2004.

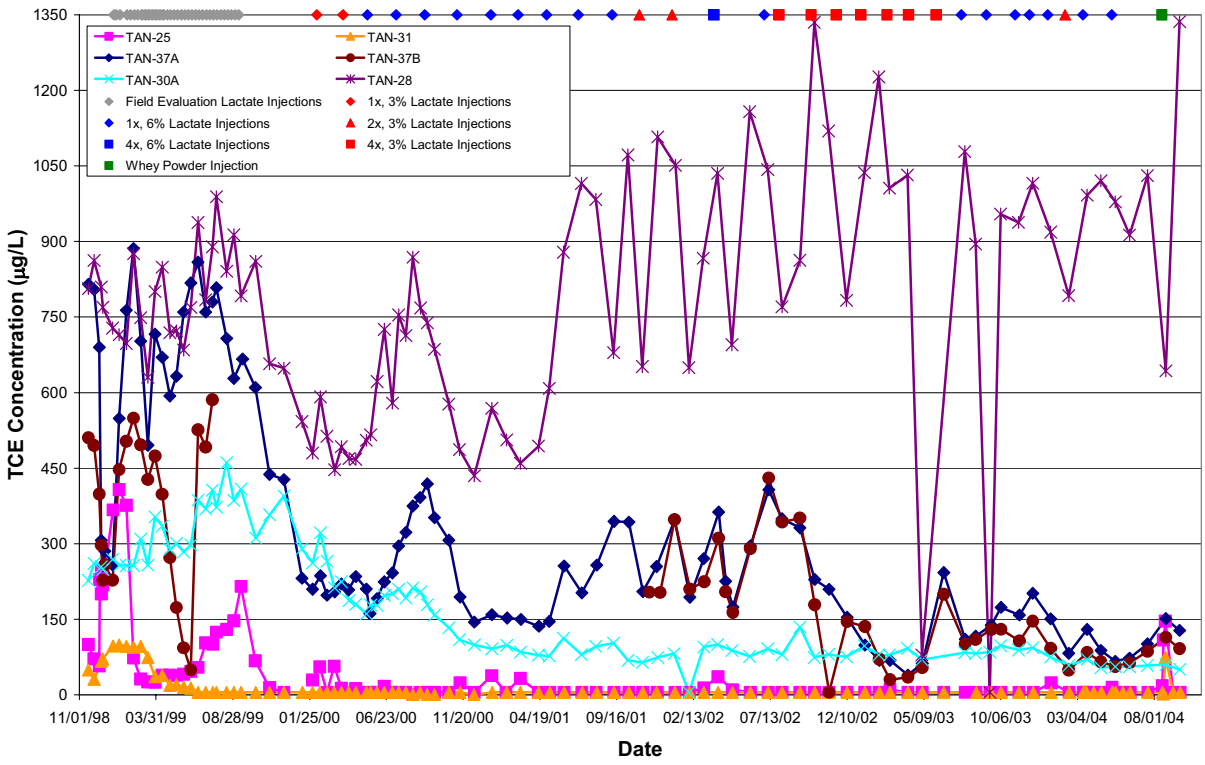



Figure 4-4. TCE concentrations in the hot spot and downgradient wells. Dates and types of injections are shown across the top of the figure (1x represents an injection volume of approximately 12,000 gal, 2x approximately 24,000 gal, and 4x approximately 48,000 gal; 3% and 6% represent the concentration of sodium lactate used in the injection solution).

The purpose of drawdown measurements is to evaluate the width of the capture zone generated by operating the NPTF extraction wells. Performance requirements—both for generating the capture zone and for conducting tests to document the width of the capture zone—are described in Subsections 4.2 and 4.2.1 of the NPTF operations and maintenance plan (DOE-ID 2003b). Water level data from wells TAN-19, -32, -33, and -36 are evaluated to ascertain whether sufficient drawdown is achieved when the extraction well pumps are in operation. Wells included in this analysis (TAN-19, -32, -33, and -36) are located near the edge of the minimum required capture zone. Results of drawdown testing are shown in Table 4-4. Water levels responded from 0.025 to 0.15 ft when extraction well pumps were turned off or on. The response of water levels in these four wells to extraction well shutdown indicates that extraction wells cause drawdown at these monitoring wells; thus, the capture zone extends at least as far as these wells. Therefore, it can be concluded that the extraction wells have generated a capture zone that meets the requirement that the zone extend at least 225 ft from the medial zone centerline.

Table 4-4. Drawdown measured at selected wells.

| NPTF Shutdown Date and Time | NPTF Startup Date and Time | Drawdown Observed during Startup (ft) | | | | Post Startup Extraction Rate (gpm) | | |
|---|---|---|---|---|---|---|---|---|
| | | TAN-19 | TAN-32 | TAN-33 | TAN-36 | TAN-38 | TAN-39 | TAN-40 |
| 12/10/2001 2210 | 12/11/2001 0708 | 0.06 | 0.15 | 0.10 | 0.05 | 0 | 114 | 113 |
| 02/27/2002 1000 | 02/27/2002 1650 | 0.06 | 0.05 | 0.07 | 0.06 | 126 | 117 | 0 |
| 04/18/2002 0705 | 04/18/2002 1306 | 0.07 | 0.06 | 0.08 | 0.07 | 122 | 120 | 0 |
| 03/19/03 1000 | 03/19/03 1600 | 0.025 | 0.05 | 0.04 | 0.02 | 0 | 85 | 146 |
| 05/09/03 1000 | 05/12/03 1102 | 0.05 | 0.05 | 0.06 | 0.016 | 0 | 92 | 153 |
| 09/24/03 1300 | 09/24/03 1600 | 0.06 | 0.05 | 0.07 | 0.06 | 103 | 81 | 0 |
| 03/01/04 0935 | 03/01/04 1520 | 0.05 | 0.06 | — | 0.06 | 103 | 100 | 0 |
| 09/15/04 1200 | 09/15/04 1400 | 0.023 | 0.04 | 0.04 | 0.03 | 99 | 0 | 90 |

Limits for VOCs discharged from the NPTF to the atmosphere are described in the *New Pump and Treat Facility Remedial Design Test Area North Operable Unit 1-07B* (DOE-ID 2000b). As shown in Figure 4-5, mass flow rates of VOC COCs in NPTF air effluent remained well below permissible limits. The VOC emissions from NPTF air strippers to the atmosphere were calculated in two ways. The first approach was to calculate the VOC mass flow rate using VOC concentrations measured in air stripper off-gas samples (the air effluent approach). The second approach was to assume that all VOCs dissolved in NPTF influent water were removed and transferred to the air stream and then discharged to the atmosphere (the water influent approach).

Baseline facility performance refers to the effect of NPTF operations on groundwater quality in five selected wells near the NPTF. Contaminant concentrations in Well TAN-33 are presented in Figure 4-6 to illustrate the change in contaminant concentrations from the time the well was installed in 1997 until the start of NPTF operations in 2001. Similar contaminant concentration trends have been observed in Wells TAN-36, -43, and -44, which are located near the NPTF. All data are shown in NPTF annual reports (INEEL 2003b; ICP 2004b; ICP 2005).

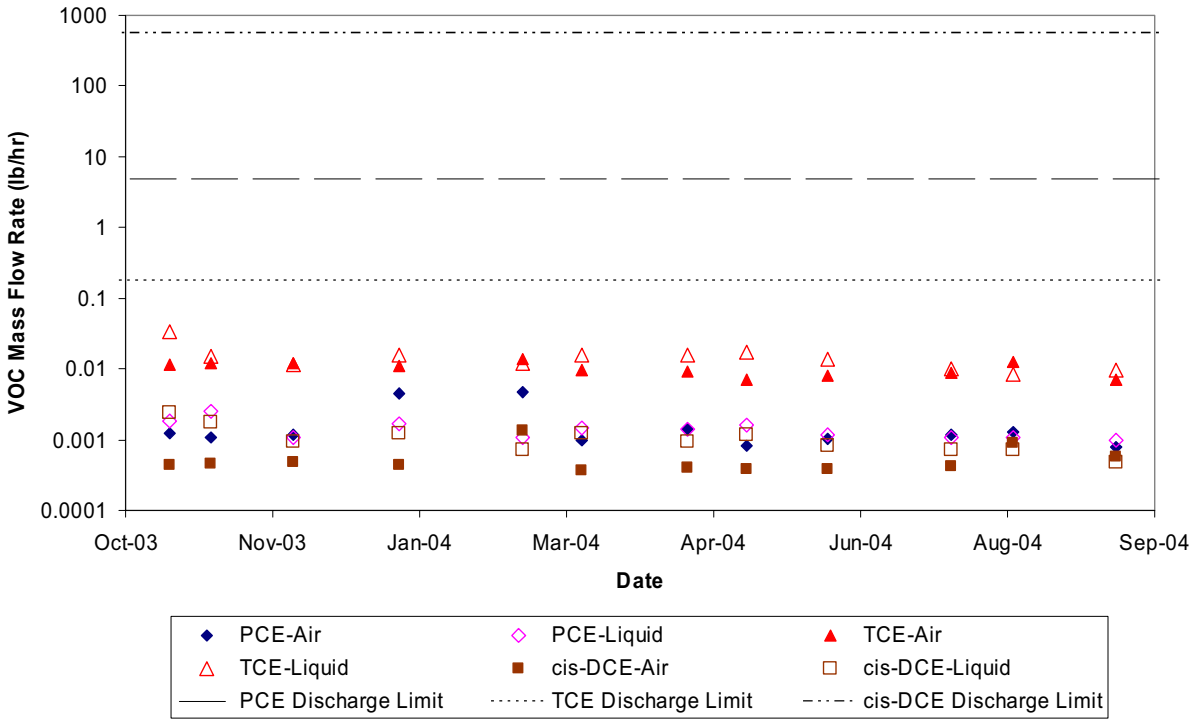



Figure 4-5. Calculated mass flow rate of VOCs emitted in the off-gas of the NPTF.

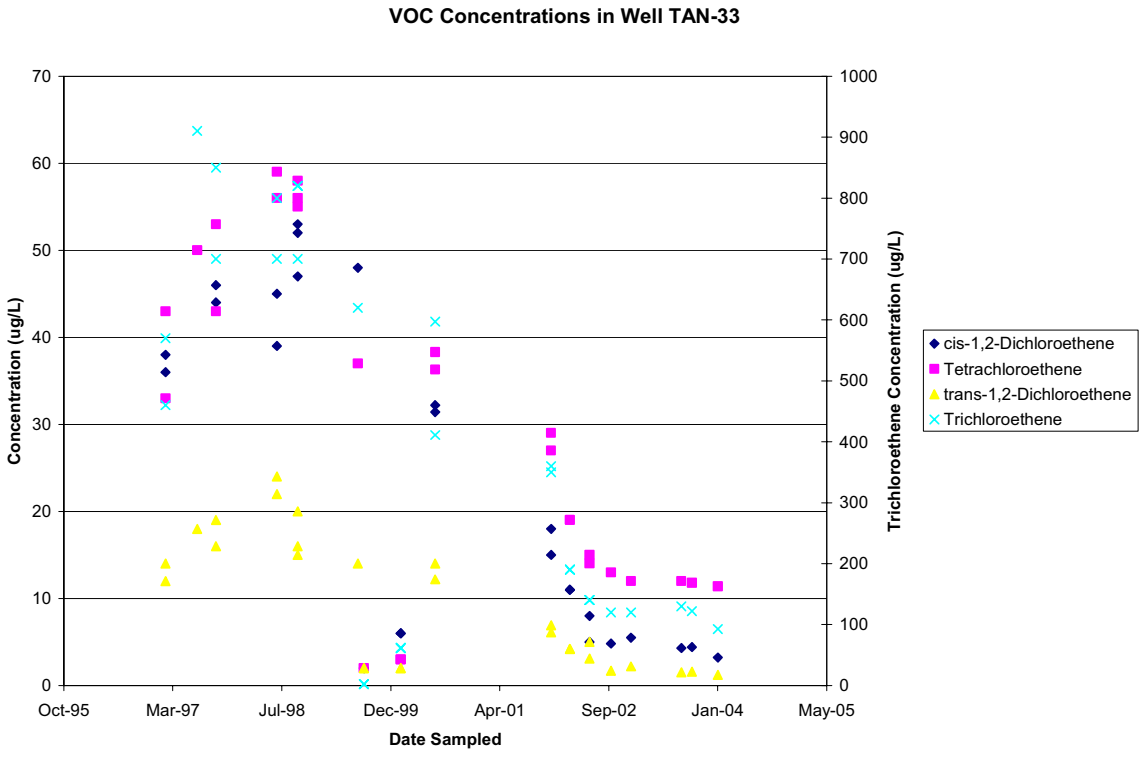



Figure 4-6. Concentration of contaminants present in groundwater samples collected from Well TAN-33.

***4.1.2.3 Distal Zone.*** Technical information supporting implementation of MNA includes the following:

- **Identification of a TCE Degradation Mechanism**—An aerobic cometabolic degradation mechanism for TCE has been identified for the OU 1-07B distal zone through direct (presence of enzymes capable of degrading TCE) and indirect (presence of conditions conducive to cometabolism) evidence both within and outside of the plume.
- **Determination of the TCE Degradation Rate**—A TCE degradation rate of 13.2 years was determined based on a spatial trend comparison of TCE and tritium (a conservative co-contaminant) concentration ratios.
- **Monitoring the Size of the TCE Plume**—Ongoing monitoring has indicated that the plume has not expanded.
- **Determining Peak TCE Concentration Breakthrough**—Dates of peak TCE concentrations at monitoring locations (TAN-16, -21, -51, -52, -54, -55, -56, -57, -58, ANP-8, and GIN-4) in the distal zone were determined through numerical modeling. Future groundwater monitoring will confirm breakthrough of peak TCE concentrations. Monitoring well locations are shown in Figure 4-1. Figure 4-7 shows TAN-16 data as an example.
- **Evaluating Radionuclide Data**—Ongoing monitoring (TAN-25, -28, -29, -30A, -37, and TSF-05) has indicated that attenuation processes of radioactive decay and sorption of radionuclides to aquifer materials continue to be functional within the plume. No migration of Sr-90 and Cs-137 from the source area has been observed, and tritium and U-234 have not been detected above MCLs. See Figure 4-1 for monitoring well locations.

Additional evaluation of MNA data are presented in MNA annual reports (INEEL 2003c; DOE-ID 2004a; Harris and Lebow 2005).

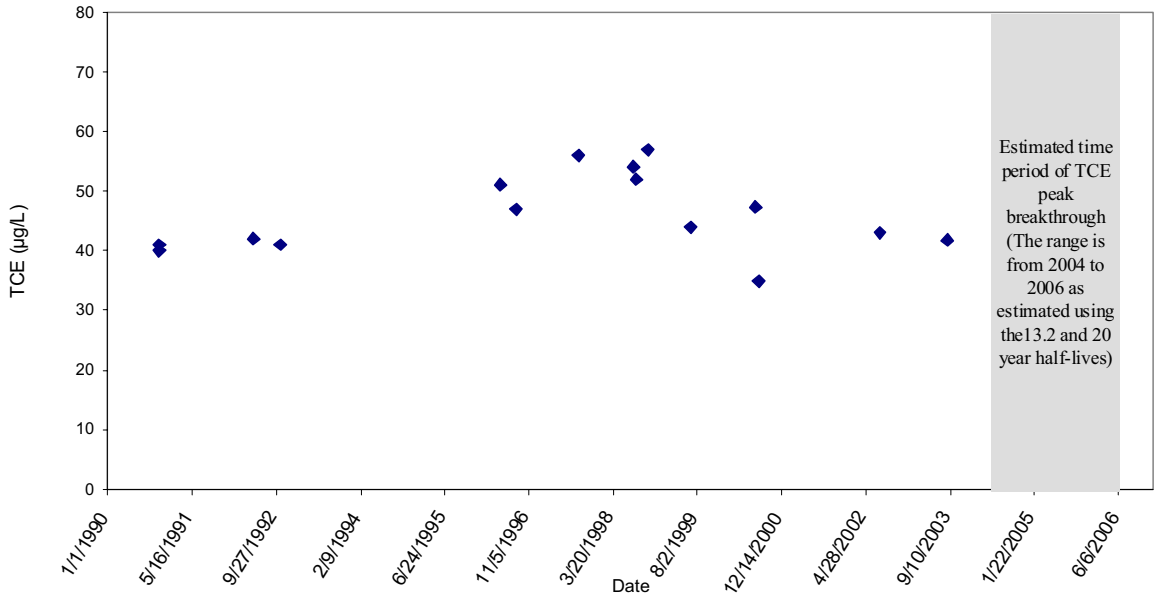



Figure 4-7. TCE peak breakthrough analysis for Well TAN-16.

### 4.1.3 Progress since Last Review

The TSF-05 ROD amendment was signed in 2001 (DOE-ID 2001a), so this is the first five-year review for OU 1-07B.

### 4.1.4 Technical Assessment

#### *4.1.4.1 Hot Spot-In Situ Bioremediation*

**Question A:** *Is the remedy functioning as intended by the decision documents?*

**Performance Monitoring Results—**ISB data have been analyzed, reviewed, and documented in annual reports (INEEL 2002a; INEEL 2003a; Armstrong et al. 2004; Macbeth et al. 2005). A review of the performance monitoring results indicates that ISB is functioning as intended per the decision documents.

**Operations and Maintenance—**Operations and maintenance of the ISB system encompass maintaining all equipment in operational status in order to perform amendment injections, sampling activities, and field laboratory activities. Routine inspections of safety equipment are completed as specified in project procedures. Since the 2001 ROD amendment (DOE-ID 2001a), the amendment injection system has transitioned from a manual, aqueous, one-well injection system to construction of a facility that houses an aqueous- and solid-phase injection system with the capability to inject into three wells. The facility also contains a field laboratory and office space.

**Implementation of Institutional Controls—**The institutional controls identified in the 2001 ROD amendment and the ISB remedial action work plan have been implemented and were verified during the pre-final/final inspection conducted on October 16 and 17, 2003. Details about the overall OU 1-07B project institutional controls are documented in the sitewide institutional controls plan (DOE-ID 2004b).

**Question B:** *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?*

Exposure pathways and land use have not changed since the 2001 ROD amendment was approved. Additionally, there have been no new contaminants, nor have there been any remedy by-products, that would affect the original assumptions. The RAOs identified in the ROD amendment are still valid, and the remedy for the hot spot of the contaminant plume continues to progress as anticipated.

**Question C:** *Has any other information come to light that could call into question the protectiveness of the remedy?*

No.

#### *4.1.4.2 Medial Zone-New Pump and Treat Facility*

**Question A:** Is *the remedy functioning as intended by the decision documents?*

**Performance/Compliance Monitoring Results—**NPTF data have been analyzed, reviewed, and documented in annual reports (INEEL 2003b; ICP 2004b; ICP 2005). A review of the performance and compliance monitoring results obtained during the first three years of NPTF operations indicates that the remedy is functioning as intended per the decision documents.

**Operations and Maintenance—**Operations and maintenance of the NPTF encompass maintaining all equipment in operational status and inspecting the system daily when it contains hazardous waste. During the reporting period, the NPTF operated more than 98% of the time. Daily inspections were completed as required.

**Implementation of Institutional Controls—**The institutional controls identified in the 2001 ROD amendment and the NPTF remedial action work plan have been implemented. Details for the overall OU 1-07B project institutional controls are documented in the sitewide institutional controls plan (DOE-ID 2004b).

**Question B:** *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?*

Exposure pathways and land use have not changed since the OU 1-07B ROD amendment (DOE-ID 2001a) was approved. Additionally, there have been no new contaminants, nor have there been any remedy by-products, that would affect the original assumptions. The RAOs identified in the ROD amendment are still valid, and the remedy for the medial zone of the contaminant plume continues to progress as anticipated.

**Question C:** *Has any other information come to light that could call into question the protectiveness of the remedy?*

No.

#### *4.1.4.3 Distal Zone-Monitored Natural Attenuation*

**Question A:** *Is the remedy functioning as intended by the decision documents?*

**Performance Monitoring Results—**MNA data have been analyzed, reviewed, and documented in annual reports (INEEL 2003c; DOE-ID 2004a; Harris and Lebow 2005). A review of the performance monitoring results indicates that MNA is functioning as intended per the decision documents.

**Operations and Maintenance—**Operations and maintenance of MNA implementation encompass maintaining all equipment in operational status to conduct monitoring activities. This includes inspecting and maintaining well infrastructure and all sampling equipment.

**Implementation of Institutional Controls—**The institutional controls identified in the ROD amendment (DOE-ID 2001a) and the MNA remedial action work plan (DOE-ID 2003a) have been implemented and were verified during the pre-final/final inspection conducted on October 16, 2003. Details about the overall OU 1-07B project institutional controls are documented in the sitewide institutional controls plan (DOE-ID 2004b).

**Question B:** *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?*

Exposure pathways and land use have not changed since the OU 1-07B ROD amendment was approved. Additionally, there have been no new contaminants, nor have there been any remedy by-products, that would affect the original assumptions. The RAOs identified in the ROD amendment are still valid, and the remedy in the distal zone of the contaminant plume continues to progress as anticipated.

**Question C:** *Has any other information come to light that could call into question the protectiveness of the remedy?*

No.

### 4.1.5 Technical Assessment Summary

The remedy for OU 1-07B consists of three components: ISB for the hot spot, pump-and-treat for the medial zone, and MNA for the distal zone. According to the data reviewed, the three components are functioning as intended by the ROD amendment (DOE-ID 2001a) and decision documents. The RAOs identified in the ROD amendment are still valid, and each component of the remedy continues to progress as anticipated. Also, there have been no changes in conditions, and there is no new information that calls into question the protectiveness of any of the three components of the remedy.

### 4.1.6 Issues

No issues have been identified during this five-year review.

### 4.1.7 Recommendations and Follow-up Activities

Implementation of the OU 1-07B remedy continues to progress toward meeting the RAOs stated in the 2001 ROD amendment (DOE-ID 2001a). Optimization and validation activities are currently being conducted for each remedial component and include the following:

- **Hot Spot—**Optimize the injection strategy to achieve maximum degradation of the residual contamination source and achieve a biologically active area large enough to cut off flux of contaminants to downgradient monitoring locations.
- **Medial Zone—**Evaluate the effectiveness of NPTF operations during the medial zone rebound test by monitoring changes in TCE concentrations after NPTF shutdown.
- **Distal Zone—**Verify breakthrough of peak TCE concentrations at distal zone well locations through continued monitoring, and continue to monitor the TCE plume boundary.

### 4.1.8 Protectiveness Statement

The remedy is expected to be protective of human health and the environment upon attainment of the RAOs defined in the ROD amendment (DOE-ID 2001a). In the interim, the three components of the remedy have been implemented in accordance with the schedules stated in the appropriate remedial action work plans. All pre-final/final inspections have been completed, and all institutional controls for the remedy are in place. Interim remedial action reports for ISB and MNA are currently in preparation.

## 4.2 Operable Unit 1-10 (TAN Comprehensive Remediation)

Subsection 4.1 above described the remedial action of Sites TSF-05 and TSF-23 under the OU 1-07B ROD. The remaining 62 potential release sites at TAN were examined under the OU 1-10 comprehensive RI/FS (DOE-ID 1997). Of the 62 potential sites, 53 were found to require no cleanup actions. The nine remaining sites were found to present an unacceptable risk to human health and the environment and required remedial action. Those nine release sites are TSF-03, -06, -07, -08, -09, -18, and -26 and WRRTF-01 and -13.

The *Final Record of Decision for Test Area North Operable Unit 1-10* (DOE-ID 1999) was finalized and signed in October 1999. The ROD identified nine sites for remedial action, because contamination was present with calculated risks greater than 1E-04 and/or hazard indices greater than 1 for one or more exposure scenarios. In the 2000 remedial design/remedial action scope of work for OU 1-10 (DOE-ID 2000c), Site TSF-26 was spit into TSF-26 (PM-2A tanks [V-13 and V-14]) and TSF-26-Soils. In addition, the remedial action sites were divided into two groups. Group 1 comprises the soil-contamination area south of the turntable (Site TSF-06 Area B), the disposal pond (Site TSF-07), the soil excavation at the TSF-26 site (Site TSF-26-Soils), and the fuel leak site (Site WRRTF-13). Group 2 comprises the V-tanks (V-1, -2, and -3) and associated piping and equipment (Site TSF-09), V-tank V-9 and associated piping and equipment (Site TSF-18), the PM-2A tanks (Site TSF-26 – PM-2A tanks), and the burn pits (Sites WRRTF-01 and TSF-03) (see Figures 4-8 and 4-9). For the purpose of remediation, V-tank Sites TSF-09 and -18 were combined into one site designation (TSF-09/18), and Site TSF-21 (the IET valve pit area soil) was included in the V-tanks area of contamination.

During the development of the original remedial design/remedial action work plan for the TSF-09/18 V-tanks (DOE-ID 2002b) in 2001, the Group 2 sites were further subdivided. TSF-09/18 remained as Group 2, while the TSF-26 PM-2A tanks and the TSF-03 and WRRTF-01 burn pits were designated as Group 3.

Since the completion of the original remedial design/remedial action scope of work, a ROD amendment (DOE-ID 2004c) and ESDs were issued in 2003 (DOE-ID 2003c) and 2005 (DOE-ID 2005), documenting modifications or clarifications to remedial actions or requiring remedial actions at new sites. As presented in the ESD to the final ROD for TAN (DOE-ID 2005) issued in January 2005, new Sites TSF-46, -47, and -48 were reevaluated, found to require remedial actions, and included in the Group 2 sites. The TAN-616 caustic tank (V-4, Site TSF-19) was also identified through the ESD as requiring remedial actions. Figure 4-10 shows the location of these new sites.

Finally, as the result of post-ROD characterization sampling or other factors, and as described later in this report, remedies for several of the nine original sites were modified. The diesel fuel leak (Site WRRTF-01) was found to be a no-action site (DOE-ID 2003c). The remedy for the TSF burn pit (Site TSF-03) was changed from native soil cover to excavate and dispose (DOE-ID 2003c). The mercury spill area (Site TSF-08) was transferred from OU 1-10 to OU 10-08 for further investigation (DOE-ID 2003c). The remedy for the TSF-09/18 V-tanks was changed from contents removal and off-site treatment to contents removal with on-site treatment (sparging and solidification), V-tanks (V-1, -2, -3, and -9) removal/disposal, and soil excavation and disposal at the Idaho CERCLA Disposal Facility (ICDF) (DOE-ID 2004c). The remedy for the TSF-26 PM-2A tanks was changed from tank contents removal and treatment if necessary to tank and contents removal with disposal of the V-13 tank and contents and treatment and disposal of V-14 tank contents (DOE-ID 2005). The remedy for Pit I at the WRRTF-01 burn pits changed from native soil cover to no action, and the COC for Pits II and IV changed from lead to asbestos (DOE-ID 2003c).

A complete list of OU 1-10 remedial action sites, their respective COCs, and final remediation goals is presented in Table 4-5. Table 4-6 provides a chronology of decision documents, implementing documents, and significant events for OU 1-10. The subsequent paragraphs briefly describe the OU 1-10 remedial action sites.

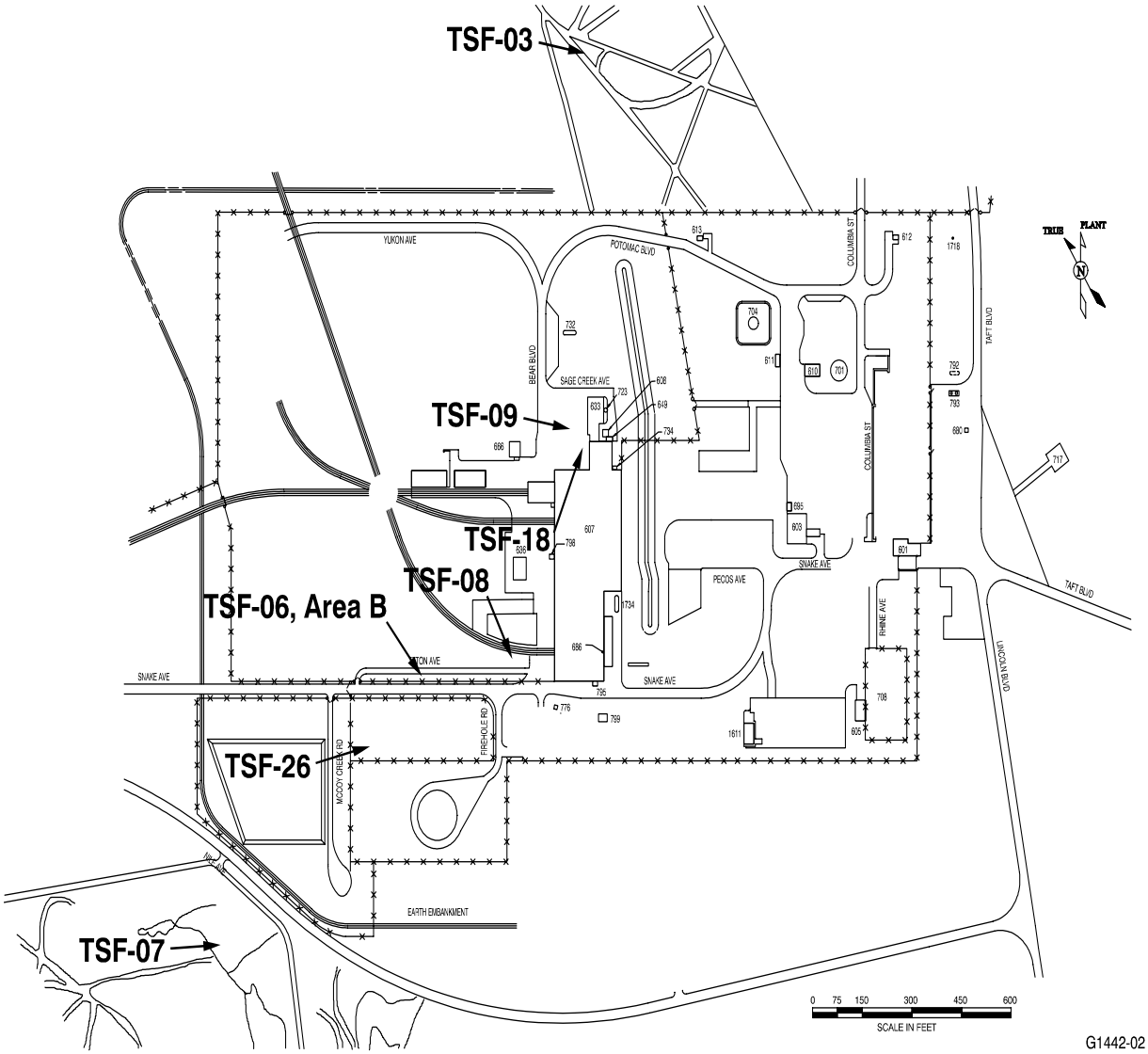



Figure 4-8. TSF remedial action sites.

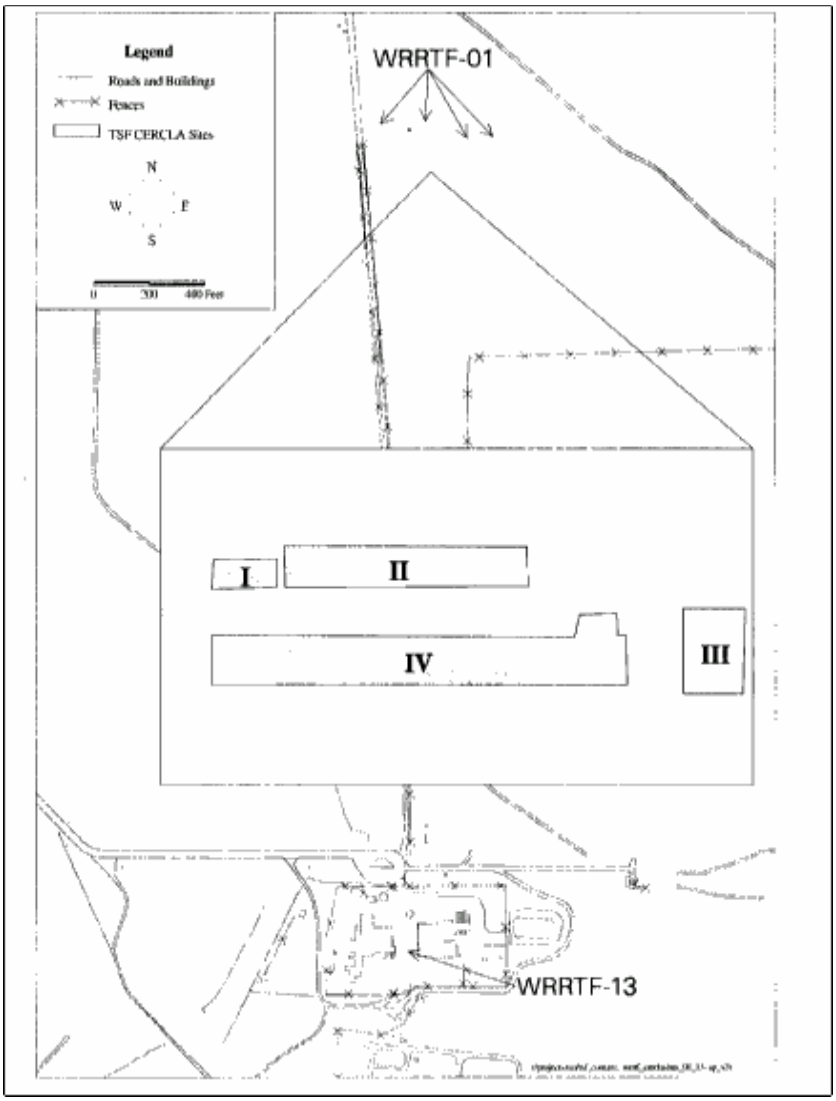



Figure 4-9. WRRTF remedial action sites.

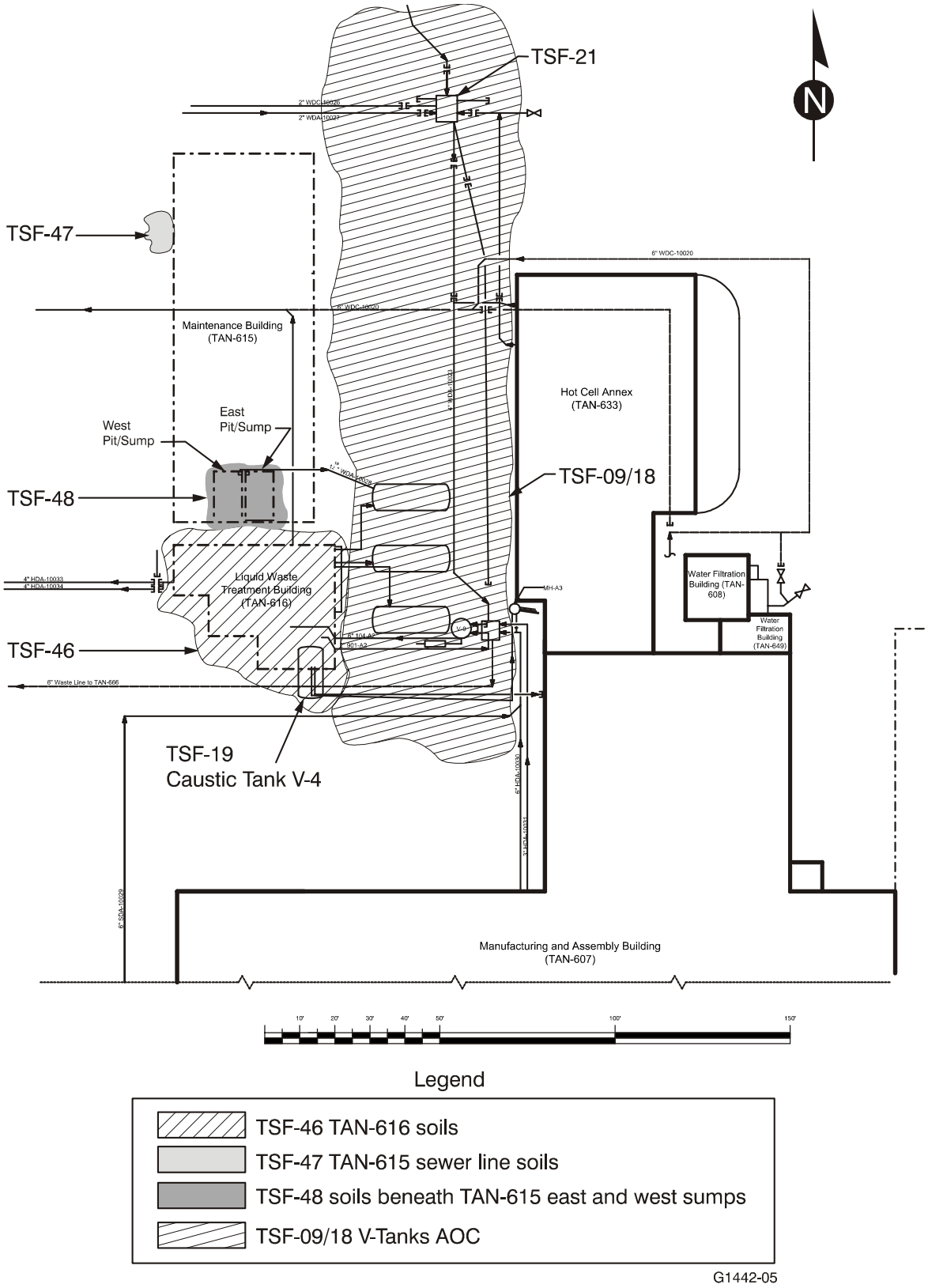



Figure 4-10. Locations of Sites TSF-19, -46, -47, and -48.

Table 4-5. COCs at OU 1-10.

| Site (Site Code) | COC | Remediation Goal |
|---|---|---|
| Group 1 Sites | | |
| Soil Contamination Area South of the Turntable (Site TSF-06 Area B) | Cs-137 | < 23.3 pCi/g |
| TSF Disposal Pond (TSF-07) | Cs-137 | < 23.3 pCi/g |
| PM-2A Tanks (TSF-26-Soils) | Cs-137 | < 23.3 pCi/g |
| WRRTF Diesel Fuel Leak (WRRTF-13) | Petroleum hydrocarbons | None required since below the risk-based corrective action Tier 2 criteria |
| Group 2 Sites | | |
| TSF Intermediate-level (Radioactive) Waste Disposal System (Tanks V-1, -2, and -3) (Site TSF-09), Contaminated Tank (Tank V-9) Southeast of Tank V-3 (Site TSF-18), and Valve Pit 2 Soils (Site TSF-21) | Cs-137 | < 23.3 pCi/g |
| V-Tank Area New Sites (TSF-46, -47, and -48) | Cs-137 | < 23.3 pCi/g |
| Caustic Tank V-4 (TSF-19) | Cs-137 | Disposal of tank and contents |
| Group 3 Sites | | |
| PM-2A Tanks (V-13 and V-14) (TSF-26-Tanks) | Cs-137 | < 23.3 pCi/g |
| TSF Burn Pit (TSF-03) | Lead | < 400 mg/kg |
| WRRTF Burn Pits II and IV (WRRTF-01) | Asbestos | Native soil cover |

Table 4-6. Chronology of OU 1-10 events.

| Document or Event | Date |
|---|---|
| The FFA/CO (DOE-ID 1991) was signed. | December 1991 |
| The *Record of Decision for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites Remedial Action* (DOE-ID 1995) was completed. | August 1995 |
| The *Comprehensive Remedial Investigation/Feasibility Study for the Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory* (Comprehensive RI/FS) (DOE-ID 1997) was completed. | November 1997 |
| The *Proposed Plan for Waste Area Group 1 Test Area North at the Idaho National Engineering and Environmental Laboratory, an OU 1-10 RI/FS Supplement* (DOE 1998a) (first proposed plan for OU 1-10 ROD) was completed. | February 1998 |
| The *Proposed Plan for Waste Area Group 1 Test Area North at the Idaho National Engineering and Environmental Laboratory an OU 1-10 RI/FS Supplement* (DOE-ID 1998b) (second proposed plan for OU 1-10 ROD) was completed. | November 1998 |
| The *Comprehensive Remedial Investigation/Feasibility Study Supplement for the Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 1998c) was completed. | November 1998 |
| The *Final Record of Decision for Test Area North Operable Unit 1-10* (DOE-ID 1999) was completed. | October 1999 |
| The *Test Area North, Waste Area Group 1, Operable Unit 1-10 Remedial Design/Remedial Action Scope of Work* (DOE-ID 2000c) was completed. | February 2000 |
| The *Field Sampling Plan for Post-Record of Decision Sampling and Field Screening of Selected Sites at Waste Area Group 1, Operable Unit 1-10* (DOE-ID 2000d) was completed. | February 2000 |
| The OU 1-10 remedial action was initiated with the start of post-ROD characterization sampling. | February 2000 |
| The TSF-26 soil pile was removed. | May 2000 |
| The TSF-06 overburden soil was removed. | July 2000 |
| The *Comprehensive Remedial Design/Remedial Action Work Plan for the Test Area North, Operable Unit 1-10, Group 1 Sites* (DOE-ID 2003d) was completed. | Rev. 0 – August 2000<br>Rev. 2 – November 2003 |
| Approval was received for a "no-longer-contained-in" determination for TSF-06 and TSF-26 contaminated soils. | September 2000 |
| Disposal of TSF-06 and -26 contaminated soils at the Radioactive Waste Management Complex was completed for soil removed in 2000. | December 2000 |
| The *Operations and Maintenance Plan for Test Area North, Operable Unit 1-10* (DOE-ID 2001c) was completed. | Rev. 1 – November 2001 |
| The *Comprehensive Remedial Design/Remedial Action Work Plan for the Test Area North, Waste Area Group 1, Operable Unit 1-10, Group 2 Sites* (DOE-ID 2002b) (original work plan for V-tanks TSF-09/18) was completed. | Rev. 0 – November 2001<br>Rev. 1 – March 2002 |
| The *Technology Evaluation Scope of Work for the V-Tanks, TSF-09/18, at Waste Area Group 1, Operable Unit 1-10* (DOE-ID 2002c) (addressed scope of work for evaluation to select new V-tanks remedy) was completed. | July 2002 |
| The *Technical Support Facility-06 and Technical Support Facility-26 Calendar Year 2000 Sampling and Remediation Summary Report for Waste Area Group 1, Operable Unit 1-10* (INEEL 2002b) was completed. | October 2002 |

Table 4-6. (continued).

| Document or Event | Date |
|---|---|
| The *TSF-03 and WRRTF-01 2000/2001 Sample Data Compilation and Risk Assessment Report for Operable Unit 1-10, Waste Area Group 1 at Test Area North* (DOE-ID 2003e) was completed. | January 2003 |
| The *Explanation of Significant Differences for the Record of Decision for the Test Area North Operable Unit 1-10* (DOE-ID 2003c) was completed. | April 2003 |
| The *New Proposed Plan for the V-Tanks Contents (TSF-09 and TSF-18) at Test Area North, Operable Unit 1-10* (DOE-ID, EPA, and DEQ 2003) (proposed plan for new V-tanks remedy) was completed. | April 2003 |
| The *Comprehensive Remedial Design/Remedial Action Work Plan Addendum for the V-Tanks Early Remedial Action for the Test Area North, Waste Area Group 1, Operable Unit 1-10* (DOE-ID 2003f) was completed. | May 2003 |
| The *Remedial Design/Remedial Action Work Plan for Group 3, PM-2A Tanks and Burn Pits for Test Area North, Waste Area Group 1, Operable Unit 1-10* (DOE-ID 2003g) was completed. | December 2003 |
| The *Record of Decision Amendment for the V-Tanks (TSF-09 and TSF-18) and Explanation of Significant Differences for the PM-2A Tanks (TSF-26) and TSF-06, Area 10 at Test Area North, Operable Unit 1-10* (DOE-ID 2004c) (ROD amendment for new V-tanks remedy and ROD change for PM-2A tanks) was completed. | February 2004 |
| The TSF-03 burn pit remediation (soil removal, soil disposal, and site backfill) was completed. | April 2004 |
| The TSF-06 Area B remediation (soil removal, soil disposal, and site backfill) was completed. | May 2004 |
| The *Risk-Based Screening and Assessment Approach for WAG 1 Soils* (INEEL 2004) was completed. | May 2004 |
| The *Group 3 Remedial Design/Remedial Action Work Plan Addendum 1 for PM-2A Tank Removal and Site Remediation for the Test Area North, Waste Area Group 1, Operable Unit 1-10* (DOE-ID 2004d) was completed. | June 2004 |
| TSF-26 PM-2A tanks (V-13 and -14) and contents were removed from the ground and temporarily placed in the TAN-607 high bay pending transport to the ICDF for treatment and disposal. | June 2004 |
| The WRRTF-01 burn pits remediation (native soil cover) was completed. | August 2004 |
| The *Group 2 Remedial Design/Remedial Action Work Plan Addendum for the Assessment and Cleanup of V-Tank Area New Sites, for the Test Area North, Waste Area Group 1, Operable Unit 1-10* (DOE-ID 2004e) (for new sites TSF-46, -47, and -48 and TSF-19) was completed. | August 2004 |
| The TSF-26 soil remediation (soil removal and disposal and site backfill) was completed. | September 2004 |
| The *Group 2 Remedial Design/Remedial Action Work Plan Addendum 2 for the TSF-09/18 V-Tanks and Contents Removal, Phase 1 Contents Treatment, and Site Remediation* (DOE-ID 2004f) was completed. | Rev. 0 – September 2004<br>Rev. 1 - November 2004 |
| The TSF-26 PM-2A tanks (V-13 and -14) and their contents were shipped to the ICDF for treatment and disposal. PM-2A Tank V-13 was placed directly in the disposal cell at the ICDF, and Tank V-14 was staged at the ICDF pending treatment prior to disposal. | January 2004 |
| The *Explanation of Significant Differences for the Record of Decision for the Test Area North Operable Unit 1-10* (DOE-ID 2005) was issued. | January 2005 |

**Soil Contamination Area South of the Turntable (Site TSF-06 Area B)—**The TSF-06 soil area is south of the turntable and is an open area bounded by the TSF fence on the west and by facility roads and several adjacent structures on the east and south. The area is roughly triangular and measures 675 ft wide on the south and 425 ft on the west. The contaminated area was radiologically surveyed by TAN personnel and covered with 1 to 2 ft of soil in 1992 (INEL 1994). The additional soil is referred to as the TSF-06 overburden, and the underlying contaminated soil is referred to as the TSF-06 native soil. Since 1992, the TSF-06 overburden has become contaminated from windblown soil containing Cs-137 that was stockpiled at the PM-2A tanks site.

**TSF Disposal Pond (Site TSF-07)—**The TSF disposal pond is a 35-acre, unlined disposal pond in the southwest portion of the TSF. The pond is surrounded by a 5-ft-tall berm.

A five-acre area in the northeast corner and on the eastern edge of the pond has been contaminated with Cs-137 and metals. However, it was assumed in the RI/FS that the area of contamination covers the entire main pond and overflow pond surfaces. Previous sampling activities indicate that the Cs-137 has migrated to approximately 11 ft below the bottom of the pond in this area.

Historically, the active portion of the pond received wastewater that included sanitary waste discharges, low-level radioactive waste, industrial wastewater, cold process water, and treated sewage effluent. The pond is currently permitted by the State of Idaho to receive sanitary and industrial waste discharges. The active portion of the pond will be assessed when operations cease.

**PM-2A Tanks and Soil (Site TSF-26)—**The PM-2A tanks site consists of two 50,000-gal abandoned underground storage tanks. The tanks were installed in the mid-1950s and stored concentrated low-level radioactive waste from the TAN-616 evaporator from 1955 to 1972 (DOE-ID 1998c). In 1972, a new evaporator system (the PM-2A system) was installed in the area to replace the existing TAN-616 evaporator system, which was failing. The tanks served as feed tanks for the new evaporator system in which liquid waste was evaporated, condensed, passed through an ion-exchange column, and discharged as clean water into the disposal pond (Site TSF-07). The system was shut down in 1975 because of operational difficulties and spills (DOE-ID 1998c).

The contents of the PM-2A tanks (V-13 and -14) consisted of a radioactive hazardous sludge with minimal liquids, because, in 1981, the tanks were partially filled with diatomaceous earth to absorb free liquid.

The soil surrounding the PM-2A tanks was contaminated as a result of spills during periodic pumping operations to remove excess liquid from the tanks. The PM-2A tank contents and surrounding soil were contained along with the hazardous constituents, including metals (barium, cadmium, chromium, lead, mercury, and silver), VOCs (TCE, 1,1,1-TCA, carbon tetrachloride, and acetone), semivolatile organic compounds, PCBs, and radionuclides (Cs-137, Co-60, and Sr-90). Based on sampling, the primary COC in the soil was Cs-137.

Contaminated soil was removed in 1996 as part of a removal action. The contaminated soil was stockpiled until eventual disposal at the Radioactive Waste Management Complex in 2000.

**WRRTF Diesel Fuel Leak (Site WRRTF-13)—**The WRRTF fuel leak site is defined as the WRRTF fuel leak site/contamination plume that is under the area where the TAN-738, -739, and -787 tanks were located. The tanks were located between Buildings 641 and 645. Numerous diesel and heating fuel tanks and transfer lines have supplied the buildings within WRRTF during its operational life.

During a startup test of the boilers in October 1991, an estimated 2,100 to 3,600 gal of diesel fuel was unaccounted for. It was suspected that either the transfer line was leaking or the boiler meters were not functioning properly. A pressure leak test indicated that a portion of the transfer piping was leaking. During excavation of the transfer line, the soil below the piping appeared discolored and smelled strongly of petroleum products. Tanks TAN-738 and -787 were removed in December 1991. When removed, TAN-738 contained numerous small holes, and soil below the tank both smelled of and appeared to be contaminated with diesel fuel.

**TSF Intermediate-level (Radioactive) Waste Disposal System (V-Tanks) (Site TSF-09) and Contaminated Tank Southeast of Tank V-3 (Tank V-9) (Site TSF-18)—**The two V-tank sites (TSF-09 and -18) have similar attributes and are located in the same area. Because of the similarities between the two sites, they were evaluated together for the ROD.

Site TSF-09 includes the three abandoned 10,000-gal underground V-1, -2, and -3 storage tanks; the contents of the tanks; and the surrounding contaminated soil and ancillary piping. Site TSF-18 includes the abandoned 400-gal V-9 underground storage tank, a sand filter, the tank contents, and the surrounding soil. The tank contents are contaminated with radionuclides, heavy metals, organic compounds, and PCBs. The surrounding soil is also contaminated with radionuclides, heavy metals, and organic compounds from spills that occurred when waste was transferred to and from the tanks.

All four V-tanks were installed in the early 1950s and used for about 30 years in a system that collected and treated radioactive waste from TAN operations, beginning with the Aircraft Nuclear Propulsion Program in the 1950s and early 1960s. Waste was piped from the adjacent research facilities into the V-9 tank, where some solids were removed. The remaining waste was then routed into one or more of the larger tanks (V-1, -2, and -3). The waste was stored in the underground tanks and then treated in the evaporator system located in TAN-616. The tanks' contents are an aqueous sludge, and nearly all of the contaminants are associated with the solid phase of the sludge.

**TSF Burn Pit (Site TSF-03)—**The TSF burn pit area was used for open burning of construction debris. The pit was used from 1953 to 1958 and is located in the northeast corner of the TSF, outside the facility fence.

The burn pit was believed to be contaminated with lead. While lead does not present a risk that can be calculated using risk guidelines, the U.S. Environmental Protection Agency (EPA) has established a residential screening level to address the human health risk caused by lead.

**WRRTF Burn Pits I, II, III, and IV (Site WRRTF-01)—**The four WRRTF burn pits were used for open burning of construction debris from 1958 to 1975. They are approximately 2,700 ft north of WRRTF, outside the facility fence.

The WRRTF burn pits were initially thought to be contaminated with lead. However, a 2003 ESD (DOE-ID 2003c) reflects the change in the COCs from lead to asbestos while maintaining the remedy of a native soil cover to Pits II and IV.

**Mercury Spill Area (Site TSF-08)—**The mercury spill area is a section of railroad bed near the southwest corner of the Building 607. In 1958, the area was contaminated by a mercury spill from the Heat Transfer Reactor Experiment-III engine. A time-critical removal action was performed in 1994, and the area was backfilled with clean gravel. Post-removal action sampling showed low levels of mercury at least 2.5 ft below ground surface.

**V-Tank Area New Sites (Sites TSF-46, -47, and -48)—**The August 2004 remedial design/remedial action work plan addendum (DOE-ID 2004e) discusses three new CERCLA sites that have been identified in the vicinity of the V-tanks (Sites TSF-09 and -18). These new sites are TSF-46, -47, and -48, as identified in Figure 4-10.

Site TSF-46 includes the soil around the perimeter of Building 616 that was originally identified as a new site in 1998. A Track 1 evaluation completed in September 2000 specifically addresses the contamination in the exterior environment of Building 616 (DOE-ID 2001d). This includes the soil beneath Building 616 and the soil on the north, south, and west sides of the building.

Site TSF-47 (TAN-615 sewer line soil) is associated with a damaged 6-in. sanitary sewer line discovered during decontamination, decommissioning, and excavation of the north end of Building 615. Work crews identified soil overlying the damaged sanitary sewer line that was radiologically contaminated.

Site TSF-48 (soil beneath TAN-615 east and west pits/sumps) is in the south half of the former Building 615. The east pit/sump was located in the fuel assemblies test area. The west pit/sump was located in the decontamination area.

**TAN-616 Caustic Tank (Site TSF-19)—**Site TSF-19 is a caustic tank that was the feed tank for providing caustic solution to neutralize the waste in the V-tanks. The unit ceased operation in the late 1970s. Initial investigation in the 1990s indicated that the tank was empty, and the OU 1-10 ROD (DOE-ID 1999) identified TSF-19 as a no-action site. However, further investigation as part of the removal of Building 616 revealed that the TSF-19 caustic tank was not empty and that some radioactive contamination was present. Thus, the status of the tank was changed per a 2005 ESD (DOE-ID 2005).

### 4.2.1 Remedial Actions

The following subsections describe the remedy selection, RAOs, remedy implementation, and ongoing remedy scope for OU 1-10 sites. Remedial actions are discussed in three groups, as previously identified in Table 4-5.

#### *4.2.1.1 Remedy Selection.*

The following paragraphs provide brief descriptions of the remedies selected for the OU 1-10 sites.

**Soil Contamination Area South of the Turntable (Site TSF-06 Area B) (Group 1)—**The selected remedy for the soil contamination area south of the turntable was soil excavation and disposal. The remedy is consistent with previous removal actions at TAN and consolidates the low-level radionuclide-contaminated soil/sediments in a centralized repository. Excavation involves removal of soil contaminated with Cs-137 above 23.3 pCi/g to a maximum depth of 10 ft and includes contaminated soil that may be identified under Snake Avenue as part of the Site TSF-06 Area B remedial action. Excavated soil will be disposed of at the ICDF. Confirmation sampling will be conducted to ensure that all contamination present above the final remediation goal is removed. The excavated areas will be backfilled with clean soil after excavation. Institutional controls are required until the site is available for unrestricted land use, and the site will be evaluated during five-year reviews.

**TSF Disposal Pond (Site TSF-07) (Group 1)—**The TSF disposal pond will continue to receive wastewater until TSF ceases operation. The selected remedy for the disposal pond is limited action. The remedy is specific to implementing existing management practices, including institutional controls and environmental monitoring, and will continue until the agencies agree that the site no longer poses an unacceptable risk to human health and the environment. The limited action will address the low-level

threat posed by the waste at Site TSF-07. The major components of the limited-action designation included sampling soil, inspecting existing operational controls, implementing institutional controls as needed, and monitoring the environment for at least 100 years.

The selected remedy also includes installation of warning signs to prevent access. Although contamination will remain in place, the radioactivity will decay to less than unrestricted land use concentrations within the period of institutional controls. Implementation of institutional controls and environmental monitoring will be expanded to accommodate site-specific concerns as needed.

**PM-2A Tanks Soil (Site TSF-26) (Group 1)—**The soil excavation and disposal tasks at the PM-2A tanks site will be completed as part of the Group 1 sites remedial design/remedial action work plan. Excavation will involve removing contaminated soil that is above the 23.3-pCi/g final remediation goal for Cs-137 to a maximum depth of 10 ft and then packaging and transporting the soil for disposal at the ICDF. The disposal is also applicable to the Site TSF-26 stockpiles that were bagged to support post-ROD sampling activities. Using radiological screening, uncontaminated soil (those with activities less than the final remediation goal) will be stockpiled separately from the contaminated soil. Waste characterization sampling will be conducted on the stockpiled soil. Confirmation sampling will be conducted to ensure that all contamination above the final remediation goal is removed.

Based on the sampling results, uncontaminated soil will be placed over any remaining contaminated soil that is deeper than 10 ft to prevent further spread of contamination. Institutional controls will be evaluated based on the results of the verification sampling. Institutional controls will be maintained until the site is available for unrestricted land use and will be reevaluated during five-year reviews.

**WRRTF Diesel Fuel Leak (Site WRRTF-13) (Group 1)—**The selected remedy for the WRRTF diesel fuel leak has been revised from the original remedy designated in the ROD.

A risk-based corrective action (RBCA) analysis was performed in 2000 using the State of Idaho RBCA guidance (DEQ-RBCA Document #2). The analysis showed that no remedial action was required for Site WRRTF-13. The evaluation of the remedy was performed as specified in the 1999 OU 1-10 ROD and documented in the *WRRTF-13 Calendar Year 2000 Sampling and Risk Based Corrective Action Analysis Summary Report* (INEEL 2002c).

Based on the additional soil sample results and the RBCA analysis, no soil volume exceeded the action levels; therefore, this site became a no-action site. The evaluation of the new data and subsequent RBCA analysis based on a residential scenario is consistent with the ROD and has resulted in a determination that neither remedial actions nor institutional controls are required. The change in the remedy for Site WRRTF-13 is documented in the *Explanation of Significant Differences for the Record of Decision for the Test Area North Operable Unit 1-10* (DOE-ID 2003c).

**TSF Intermediate-level (Radioactive) Waste Disposal System (V-Tanks) (Site TSF-09) and Contaminated Tank Southeast of Tank V-3 (Tank V-9) (Site TSF-18) (Group 2)—**The two V-tank sites (TSF-09 and -18) have similar attributes and are located in the same area. Because of the similarities of the two sites, they were evaluated together for the ROD, and the same remedy was selected for both sites. The original remedy designated in the 1-10 ROD required that the contents of V-tanks be treated at an off-site facility. After promulgation of the ROD, the off-site treatment option became unavailable. An alternate remedy was approved in the 2004 ROD amendment and ESD (DOE-ID 2004c). An additional treatment option was approved in the 2005 ESD (DOE-ID 2005). The final remedy selected includes soil excavation and disposal, tank contents treatment, treated waste solidification, and disposal.

**Caustic Tank V-4 (Site TSF-19) (Group 2)—**Further investigation as part of the removal of Building 616 and the TSF-46 new site revealed that the TSF-19 caustic tank was not empty and that some radioactive contamination was present. Video inspection of the inside of the tank revealed a significant heel was still present. As a result of finding waste within TSF-19, the status of the tank and surrounding soil will be changed from no action to remediation required in conjunction and consistent with the TSF-46 site that surrounds the TSF-19 caustic tank. The tank and contents will be removed, treated as necessary, and shipped to the ICDF or another approved disposal facility.

**V-Tanks Area New Sites (Sites TSF-46, -47 and -48) (Group 2)—**Sites TSF-46, -47, and -48 and the two V-tank sites (TSF-09 and -18) have similar COCs in the soil based on historical data (see the V-tanks new sites remedial design/remedial action work plan addendum [DOE-ID 2004d]) and are located in the same area just north of the TAN-607 facility. As a result, the same remedy and final remediation goal as the V-tanks soil is being implemented for these new sites: the soil will be excavated and disposed of at the ICDF, and confirmation sampling will be performed to ensure the final remediation goal designated in the 1999 OU 1-10 ROD is met (DOE-ID 1999). If the final remediation goal cannot be achieved, institutional controls will be applied.

The treatment process for the V-tanks waste may be a multi-stage process and will be conducted ex situ at the V-tanks site or in adjacent areas. The selected treatment option may include air sparging at ambient or elevated temperatures (up to and including boiling temperatures); chemical oxidation/reduction, as necessary, if the air sparging does not meet the land disposal restrictions (LDRs); and solidification. Laboratory studies will be conducted to optimize the sparging parameters and the choice of specific oxidant(s) or reductant(s). Solidification of the V-tanks consolidated waste will be necessary to meet ICDF acceptance criteria.

**PM-2A Tanks and Contents Removal (Site TSF-26 ) (Group 3)—**The original selected remedy for the PM-2A tanks was to remove the tank contents using a vacuum and to treat and dispose of the waste. The remedy was modified in the ROD amendment and ESD (DOE-ID 2004c) to removal of the tanks intact without prior removal of the contents. The remedy was further modified in the January 2005 ESD (DOE-ID 2005) to address disposal of V-13 at the ICDF without treatment and both treatment and disposal of tank V-14 at ICDF.

Plans originally called for the contents of the tanks to be treated through thermal desorption or chemical oxidation/reduction to reduce the PCE to meet LDRs and disposal facility waste acceptance criteria. A later review suggested that sparging might also be effective in reducing the levels of contaminants in the waste. Treatment studies will be conducted as necessary to select and refine the most appropriate treatment option. After treatment, the tank contents will be resampled to confirm compliance with LDRs and the applicable disposal facility waste acceptance criteria. The tanks and treated contents will be transported to the ICDF or another approved facility for disposal.

**WRRTF Burn Pits II and IV (Site WRRTF-01) (Group 3)—**When the OU 1-10 ROD was signed, the only COC identified at the burn pits was lead, so the ROD required native soil covers on Pits I, II, and IV. In 2000/2001, however, asbestos was detected in Pits II and IV during additional sampling that was part of a characterization investigation (DOE-ID 2003e). But asbestos was not evaluated in the human health risk evaluation.

The post-ROD characterization measured asbestos above action levels in Pits II and IV. Asbestos at >1% by volume is a regulatory and health and safety concern. The 2003 ESD (DOE-ID 2003c) reflects the change in the COCs from lead to asbestos while maintaining the remedy of a native soil cover for Pits II and IV.

The 2000/2001 additional investigation did not identify asbestos in Pit I, and lead was not identified above the EPA Region 9 residential preliminary remediation goal during the post-ROD characterization. Based on this information, Pit I does not require a native soil cover, and there are no restrictions on the use of the area. The remedy for Pit I was changed to no action.

Likewise, the 2000/2001 additional characterization investigation did not identify asbestos as being present in Pit III and confirmed that lead concentrations were below the EPA Region 9 residential preliminary remediation goal. Thus, the Pit III site is available for unrestricted use, and no remedial action is required.

The remedy for Pits II and IV required a soil cover followed by institutional controls (including implementation of institutional control signs) based on the presence of asbestos above action levels. Institutional controls are necessary in order to maintain the soil cover and prevent intrusion. Environmental monitoring is not necessary for sites where asbestos is the only cause for remediation. Pits I and III are no-action sites, and neither remedial actions nor institutional controls are required for them. Changing the remedy for Pit I to no action reduces the area and extent of the native soil cover. The April 2003 ESD (DOE-ID 2003c) detailed the changes in the remediation for the WRRTF burn pits.

**TSF Burn Pit (Site TSF-03) (Group 3)—**The original remedy selected in the 1999 OU 1-10 ROD for the TSF burn pit was a native soil cover to address the low-level threat posed by waste in the pit. The major component of the selected remedy included sampling to determine the cover design and the monitoring necessary to ensure that the remedy is protective and to compare costs of the soil cover and long-term monitoring with the excavation and disposal option. The remedy also included adding uniform layers of clean soil and surface vegetation to limit direct contact with the lead-contaminated soil if the soil cover option was finalized. Also included were inspections of existing institutional controls to assess their adequacy.

The 1999 OU 1-10 ROD contingent remedy was excavation and disposal of lead-contaminated soil. Under the contingency, contaminated soil exceeding the remediation goal would be removed and disposed of, and the excavation would be backfilled with clean soil. The contaminated soil would not be treated and would be disposed of at the ICDF.

The April 2003 ESD (DOE-ID 2003c) detailed a change in the remedy for the burn pit. The ESD identified the change in remedy from installation of a native soil cover to the contingent remedy of excavation and disposal. The basis for the remedy change is that the original remedy of a soil cover with long-term monitoring was more costly than the contingent remedy of excavation and disposal. The 2000/2001 additional characterization investigation sampling measured and confirmed that the lead concentrations were above the EPA Region 9 residential preliminary remediation goal of 400 mg/kg (DOE-ID 2003e).

**Mercury Spill Area (Site TSF-08)—**No remedy was selected in the 1999 OU 1-10 ROD for the mercury spill area. The ROD stated that a treatability study would be conducted to evaluate plant uptake factors and rates for phyotoremediation specific to the Idaho National Laboratory (INL) Site. A revised risk analysis would be developed using site-specific data. In the April 2003 ESD (DOE-ID 2003c), the TSF-08 mercury spill area was transferred from OU 1-10 to OU 10-08 within WAG 10. The transfer to WAG 10 was based on an agency agreement that Site TSF-08 should be included under the OU 10-08 RI/FS and future ROD. Because the site has been transferred to OU 10-08, no remediation tasks, remedial action scope, or remedial actions remain.

**Institutional Control Sites—**The ROD (DOE-ID 1999) identified 94 sites as potential release sites. Of the 94 sites, 83 were identified as being no-action sites (where land use is unrestricted) or

no-further-action sites (where institutional controls are required to restrict land use in the future). For the eight sites scheduled for remedial action, institutional controls were implemented, and the continuation of institutional controls will be determined after remediation. Two sites, TSF-23 and -05, are associated with the groundwater contamination, and institutional controls have been implemented at those sites. One site, TSF-08, was selected for a treatability study under WAG 10, but institutional controls have been implemented and maintained with the other WAG 1 sites. The ROD amendment and ESD (DOE-ID 2004c) noted that Site TSF-06, Area 10, which had been designated as a no-action site, was reclassified as a no-further-action site that requires institutional controls. Institutional controls are in place at all sites identified in the 1999 OU 1-10 ROD. A brief description of the objectives of the institutional controls for each of the WAG 1 sites is provided below.

- **Burn Pit (Site TSF-03)—**Limit exposure to contaminated soil, and maintain the integrity of native cover and/or engineered cover.
- **TAN Injection Well (Site TSF-05)—**Prevent consumption and use of groundwater below the MCL and/or 1E-04 risk.
- **Area Northeast of Turntable (Site TSF-06, Area 1)—**Limit exposure to contaminated soil, and ensure that land use is appropriate.
- **Radioactive Soil Berm (Site TSF-06, Area 5)—**Limit exposure to contaminated soil, and ensure that land use is appropriate.
- **Reactor Vessel Burial Site (Site TSF-06, Area 10)—**Limit exposure to contaminated soil, and ensure land use is appropriate.
- **Contaminated Ditch (Site TSF-06, Area 11)—**Limit exposure to contaminated soil, and ensure land use is appropriate.
- **Disposal Pond (Site TSF-07)—**Limit direct exposure to radiologically contaminated soil, and ensure land use is appropriate.
- **Mercury Spill (Site TSF-08)—**Limit exposure to contaminated soil, and ensure land use is appropriate.
- **Tanks V-1, -2, and -3 (Site TSF-09)**—Limit direct exposure to radiologically contaminated soil, and ensure land use is appropriate.
- **Drainage Pond (Site TSF-10)—**Limit exposure to contaminated soil, and ensure that land use is appropriate.
- **Tank V-9 (Site TSF-18)—**Limit direct exposure to radiologically contaminated soil, and ensure land use is appropriate.
- **Groundwater Contamination (Site TSF-23)—**Prevent consumption and use of groundwater below the MCL and/or 1E-04 risk.
- **PM-2A Area (Site TSF-26)—**Limit direct exposure to radiologically contaminated soil, and ensure land use is appropriate.
- **Sewage Treatment Plant (Site TSF-28)—**Limit exposure to contaminated soil, and ensure land use is appropriate.
- **Acid Pond (Site TSF-29)—**Limit exposure to contaminated soil, and ensure land use is appropriate.
- **Asbestos Gravel Pit (Site TSF-39)—**Limit exposure to contaminated soil, and ensure land use is appropriate.

- **Contaminated Pipe (Site TSF-42)—**Limit exposure to contaminated soil, and ensure land use is appropriate.
- **Radioactive Parts Security Storage Area Building and Pad (Site TSF-43)—**Limit exposure to contaminated soil, and ensure land use is appropriate.
- **IET Stack Rubble Site (Site IET-04)—**Limit exposure to contaminated soil, and ensure land use is appropriate.
- **Burn Pits (Site WRRTF-01)—**Limit exposure to contaminated soil, and maintain the integrity of the native cover and/or engineered cover.
- **WRRFT Fuel Leak (Site WRRTF-13)—**Limit exposure to contaminated soil, and maintain the integrity of the native cover and/or engineered cover.

During implementation of institutional controls at TAN in 2000, the following land use assumptions were made:

- INL will remain under government management and control through the 100-year scenario.
- No residential development (i.e., housing) will occur within INL Site boundaries. Grazing will be allowed to continue in the buffer area.
- No new major, private developments (residential or nonresidential) on public lands are expected in areas adjacent to the INL Site.

These assumptions led the DOE Idaho Operations Office to conclude that TAN would remain under restricted industrial until at least 2095.

#### *4.2.1.2 Remedial Action Objectives.*

This subsection summarizes the RAOs identified in the 1999 OU 1-10 ROD (DOE-ID 1999) and significant changes to the RAOs in subsequent decision documents. Complete details of the RAOs are presented in the 1999 OU 1-10 ROD, and the revised RAOs are presented in the 2004 ROD amendment and ESD (DOE-ID 2004c).

The RAOs for the V-tanks and V-tank new sites are based on results of the human health risk assessment and are specific to the COCs and exposure pathways developed for OU 1-10. The 1999 OU 1-10 ROD and the ROD amendment (DOE-ID 2004c) established RAOs for the V-tanks.

The RAO for the V-tanks area soil is to reduce risk from all pathways and all COCs to a total excess cancer risk of less than 1 in 10,000 and a total hazard index of less than 1 for the hypothetical resident 100 years in the future and for the current and future worker. The RAO for the V-tank contents is to prevent release to the environment of the V-tank contents.

The RAOs for the TSF-06 (Area B), TSF-26, TSF-07, and WRRTF-13 soil are as follows:

- Reduce risk from external radiation exposure from Cs-137 to a total excess cancer risk of less than 1 in 10,000 for the hypothetical resident 100 years in the future and the current and future worker.
- Prevent exposure to petroleum hydrocarbon constituents in accordance with the State of Idaho RBCA guidance (only applies to WRRTF-13).
- Prevent direct exposure to lead at concentrations over 400 mg/kg, the EPA residential screening level for lead (only applies to TSF-03).

The RAO for the PM-2A tanks (V-13 and -14) contents is to prevent release to the environment of the PM-2A tanks contents.

***4.2.1.3 Remedy Implementation.*** The following paragraphs briefly describe remedy implementation at the OU 1-10 sites.

**Soil Contamination Area South of the Turntable (Site TSF-06 Area B) (Group 1)—**In 2000, this site was cleared and prepared for remediation activities. Initial soil sampling and analysis were performed for the contaminated area, excluding the area under Snake Avenue. Additional radiological field screening was used to delineate the boundaries of the contamination. The areas above the 3-pCi/g screening action level were marked. Surface soil samples were collected and analyzed from hot spots. Overburden was removed, additional field screening was performed, and soil with contamination levels greater than the final remediation goal was placed in soil bags for disposal, while soil with contamination levels less than the final remediation goal was stockpiled separately. Soil bags were initially stored during preparation of waste determinations and waste profiles, allowing the soil bags to then be disposed of at the RWMC.

In 2003, additional pre-excavation soil samples were collected and analyzed from selected areas, and additional field screening was performed to delineate the boundaries of the contaminated areas. Excavation drawings (dig maps) were prepared using the results of the soil sampling and field screening. Soil excavation was only partially completed by November 2003. A pre-final inspection visit was conducted with the agencies on November 20, 2003.

Soil excavation resumed in 2003 and was completed in the spring of 2004. Confirmation sampling was also performed in 2004 to verify that the remedial action met the final remediation goal. Contaminated soil was disposed of at the ICDF. The excavation area was backfilled, restored, contoured, and graded. The post-excavation pre-final inspection was conducted on June 25, 2004. Institutional controls were maintained after completion of the remedial action.

Remedial action scope remaining for Site TSF-06 Area B includes completing the disposal of secondary waste at the ICDF and providing notice to Long-term Stewardship to revise the sitewide operations and maintenance plan to address monitoring for and control of noxious weeds.

All documents for Site TSF-06 Area B remediation have been completed except for the pre-final inspection report and the OU 1-10 Groups 1 and 3 remedial action report. The remedial action report will include a detailed discussion of all remedial action activities, confirmation sampling results to address the final remediation goal, and any application of institutional controls.

**TSF Disposal Pond (Site TSF-07) (Group 1)**—The limited-action remedy for the TSF disposal pond was implemented via the remedial design/remedial action work plan for Group 1 sites (DOE-ID 2003g). It was determined that sampling for a no-longer-contained-in determination was not required, and institutional controls were implemented in 2001. Annual radiological surveys around the perimeter of the disposal pond were also implemented in 2001.

When use of the disposal pond ceases (expected in about 2012), the existing institutional controls and monitoring will be evaluated, and, if deemed appropriate, the institutional controls and monitoring will be revised with new, upgraded practices and controls. Details of institutional control requirements at the disposal pond are in the sitewide institutional control plan (DOE-ID 2004b). Details of the radiological monitoring are detailed in the sitewide operations and maintenance plan (DOE-ID 2004g).

Remaining limited action scope for the disposal pond includes annual site radiological surveys, review of administrative and institutional controls, and future five-year reviews. Specific future tasks also include the following:

- Further assessment after discharge to the pond ceases (expected in about 2012)
- Sampling in 2071 to verify the site is available for unrestricted land use.

Outstanding documents related to the future tasks indicated above include the following:

- Reports associated with the annual surveys, institutional control update reports, future five-year reviews, and the results of the 2071 surveys
- OU 1-10 Groups 1 and 3 remedial action report
- Field sampling plan for further assessment after discharge to the pond ceases and the planned sampling in 2071.

**PM-2A Tanks Soil (Site TSF-26) (Group 1)—**In 2000, prior to the excavation of any soil for the remediation of the PM-2A soil, the area was cleared and prepared for remediation activities and included an initial radiation survey. Initial post-ROD soil sampling and analysis of the soil stockpiles were performed per the field sampling plan. After the initial analytical results were received, the soil stockpiles were removed and placed in soil bags. Radiological field screening delineated the boundaries of the contaminated areas. Surface soil samples were collected from radiological hot spots, and the samples were submitted for analysis. Results of the analysis were submitted to the agencies. The bags of soil were initially stored before disposal at the RWMC.

In 2003, additional pre-excavation soil samples were collected and analyzed from selected areas. Additional field screening was performed to delineate the boundaries of the contaminated areas. Excavation drawings (dig maps) were prepared using the results of the soil sampling and field screening. From the November 2003 pre-final inspection by the agencies, it was determined that the confirmation approach was inadequate and that additional confirmation sampling needed to be performed in 2004. Excavation and transportation of soil to the ICDF were curtailed by the end of November 2003 and did not resume until April 2004.

In 2004, excavation resumed and confirmation sampling was performed to verify that all soil above the final remediation goal of 23.3 pCi/g for Cs-137 had been removed. Contaminated soil was disposed of at the ICDF. The excavation area was photographed and backfilled with clean soil, and the excavation area was surveyed for the record. Six inches of topsoil was placed over the backfilled area. The requirement for revegetation was deleted per agency agreement on November 2, 2004. The pre-final inspection site visit by the agencies was conducted on September 8, 2004.

Remaining scope for the Site TSF-26 tanks soil includes completing the disposal of secondary waste and providing notice to Long-term Stewardship that previously established institutional controls are to continue. All documents for the tanks soil remediation have been completed, except for the following:

- Pre-final inspection report
- OU 1-10 Groups 1 and 3 remedial action report, which will include a detailed discussion of all remedial action activities, confirmation sampling results, and any application of institutional controls.

**WRRTF Diesel Fuel Leak (Site WRRTF-13) (Group 1)—**Using the results of post-ROD sampling and a further risk assessment for the WRRTF diesel fuel leak (INEEL 2002c), WRRTF-13 has been revised to a no-action site. No additional scope items remain to be completed (DOE-ID 2003c).

All documents for the WRRTF diesel fuel leak no-action site have been completed, except for the OU 1-10 Groups 1 and 3 remedial action report, which will include a discussion of the remedy change and sampling results to designate WRRTF-13 as a no-action site.

**TSF Intermediate-level (Radioactive) Waste Disposal System (V-Tanks) (Site TSF-09) and Contaminated Tank Southeast of Tank V-3 (Tank V-9) (Site TSF-18) (Group 2)—**Additional sampling of the contents of the V-9 tank was performed in April 2001. A remedial design/remedial action work plan was finalized in November 2001 to implement the original remedy for the V-tanks (DOE-ID 2001b). However, in early 2002, a review was conducted to reassess the remedy and path forward for the V-tanks due to the loss of the off-site treatment facility in late 2001. Based on the review, the agencies agreed that the remedy options should be reevaluated. The waste treatment technology evaluation concluded that chemical oxidation was the most viable alternative for treatment of the V-tank contents. The results of the technology evaluation and the new preferred alternative of contents removal and on-site treatment were summarized in the April 2003 proposed plan for the V-tanks (DOE-ID, EPA, and DEQ 2003). The selection of the new remedy was reported in the V-tanks ROD amendment (DOE-ID 2004c).

In 2003, laboratory and bench-scale testing was conducted to determine the chemical oxidation and stabilization parameters for V-tanks waste treatment. The testing concluded that a chemical oxidation system based on hydrogen peroxide would destroy most of the VOCs (including PCB arochlor-1260) in the V-tanks waste. Also, soil sampling and analysis were performed in 2003 to further delineate or bound the extent of soil contamination in the area of contamination under an addendum to the V-tanks remedial design/remedial action work plan.

In 2004, initial tasks completed included system mockup testing. The mockup testing demonstrated sludge removal equipment and equipment efficacy, resulted in modifications of the equipment, and incorporated the changes into a revised design. The excavation to the top of the V-tanks was completed, and the associated piping was removed. Additional laboratory testing also concluded that VOCs would likely be successfully separated from the overall waste matrix with only air or oxygen sparging at elevated temperatures without supplemental chemical oxidation, thus allowing for a simplified cleanup strategy.

The remaining remedial actions for Sites TSF-09 and -18 include Phase 1 equipment installation in addition to treatment, tank removal, soil excavation and disposal, backfilling, and final reporting. A pre-final inspection will be conducted after the integrated system operability and leak testing is completed.

With the completion of final equipment assembly and testing, the waste from the V-tanks will be transferred to consolidation tanks. The empty V-tanks will then be flushed and rinsed. Once the waste is in the consolidation tanks, Phase 1 treatment will begin with air sparging at ambient temperature. The sparged waste will be recirculated between the consolidation tanks. If the air sparging does not treat the VOCs sufficiently to achieve the LDR requirements, then additional treatment using chemical oxidation/reduction methods will be utilized until the LDR requirements are met. If chemical oxidation is needed, then Addendum 3 to the Group 2 V-tanks remedial design/remedial action work plan will be prepared.

After Phase 1 treatment by air sparging is completed, the sparged waste will be sampled and analyzed. If the treated waste is not characteristic and meets the LDR treatment standards, then the treated waste will be solidified and transported to the ICDF for disposal.

After the waste has been completely transferred from the V-tanks and the tanks have been flushed and rinsed, they will be removed from the excavation. All contaminated soil at the site will be excavated, and confirmation sampling will be performed to ensure that the final remediation goal has been met. After any additional excavation necessary to remove the contaminants, the excavation will be backfilled with clean soil to the original land surface. The excavated contaminated soil and the empty V-tanks will be transported to the ICDF for disposal.

TSF-09 and -18 remedial action documents that need to be completed include the following:

- Pre-final inspection report
- Group 2 V-tanks remedial design/remedial action work plan Addendum 3 (if necessary)
- OU 1-10 Group 2 remedial action report, which will include a detailed discussion of all remedial action activities, confirmation sampling results to address the final remediation goal, and any continued application of institutional controls.

**Caustic Tank V-4 (Site TSF-19) (Group 2)**—The V-4 caustic tank was removed and placed into CERCLA storage as part as an activity conducted in conjunction with Building 616 decontamination and dismantlement. Liquid in the tank was removed after the tank was placed in storage, and both the liquid and the caustic heel in the tank were sampled.

The remaining scope for the V-4 caustic tank includes making a final waste determination, preparing a waste profile, and disposing of the liquid and the tank.

Remedial action documents that need to be completed for the V-4 caustic tank include the following:

- Pre-final inspection report
- OU 1-10 Group 2 remedial action report, which will include a detailed discussion of the actions taken to characterize and dispose of the tank and contents.

**V-Tanks New Sites (Sites TSF-46, -47, and -48) (Group 2)—**Soil excavation began with the demolition of Building 616. Soil was excavated at various stages to provide access to the foundation of the building below grade surface. The contaminated soil around Building 616 was stockpiled and ultimately disposed of at the ICDF in 2004.

Characterization samples were obtained from the soil beneath the building foundation in the pump room and evaporator pit areas. The soil in those areas is radiologically contaminated and was bagged and staged pending shipment to the ICDF.

The remaining scope to complete the remedial actions for the Sites TSF-46, -47, and -48 includes soil excavation and disposal, backfilling, and final reporting. All contaminated soil at the sites will be excavated, and confirmation sampling will be performed to ensure that the final remediation goal has been met.

Remedial action documents that need to be completed for the new sites include the following:

- Pre-final inspection report
- OU 1-10 Group 2 remedial action report, which will include a detailed discussion of all remedial action activities, confirmation sampling results to address the final remediation goal, and continuing application of institutional controls.

All remedy activities will be included in the Group 2, V-tanks pre-final inspection report and remedial action report.

**PM-2A Tanks and Contents Removal and Contents Treatment (Site TSF-26) (Group 3)**—In 2003, post-ROD sampling was completed on the PM-2A tank contents, and samples were analyzed to ascertain whether treatment of the contents was required. Based on that sampling, it was determined that the V-13 tank contents did not require treatment, and the V-14 tank contents did require treatment.

In 2004, tank removal actions were initiated with excavation of soil and removal of the process feed and utility piping within the tank excavation footprint. During remedial design activities, it was determined the tanks were structurally strong enough to be removed intact with the contents still inside. In addition to avoiding potential worker exposure, removal of the tanks with the contents inside is faster and cheaper. As provided in the original selected remedy, the tank contents would be treated as necessary to meet LDRs and stabilized to meet other waste acceptance criteria for disposal at the ICDF or another approved facility.

As part of the PM-2A tank excavation work, the tank manway access pipe and tank vent line were removed, transported, and disposed of at the ICDF. Sand was removed from the ends and side of the tank cradles, and the sand that was removed was monitored both visually and radiologically for contamination. The sand was then transported and disposed of at the ICDF.

After preparing the tanks for lifting and transport, they were removed from the excavation and visually inspected for evidence of any releases. The PM-2A tanks were transported to the TAN-607 high bay for temporary storage on June 26 and 27, 2004. The sand in each tank cradle and from the surrounding area was inspected and surveyed.

Wide-area confirmation screening was conducted in the tanks' excavation to measure any remaining Cs-137 contamination and to ascertain whether remaining concentrations of contaminants would require institutional controls. Soil samples were collected beneath the process feed piping. Excavated soil and feed piping were transported and disposed of at the ICDF. The excavation was backfilled with excavated soil or clean soil up to the bottom of the Snake Avenue road base. A pre-final inspection site visit was conducted on July 21, 2004.

In January 2005, the PM-2A tanks (V-13 and -14) and contents were shipped to the ICDF for treatment and disposal. Tank V-13 was placed in the ICDF disposal cell, and Tank V-14 has been staged at the ICDF pending treatment of the contents prior to disposal.

Several tasks remain before the remedial action associated with the PM-2A contents removal is finished. These tasks include the following:

- Conduct a CERCLA risk evaluation based on the results of samples collected from contaminated soil in the piping release area, and remove and containerize waste from the process feed piping.
- Address soil contaminated from a hydraulic oil leak and liquid removed from the PM-2A piping.
- Treat the Tank V-14 contents, and dispose of the tank and treated contents at the ICDF.

All documents associated with the PM-2A contents removal have been completed, except for the following:

- Pre-final inspection report
- OU 1-10 Groups 1 and 3 remedial action report, which will include a detailed discussion of all remedial action activities, confirmation sampling results to address the final remediation goal, and any continued application of institutional controls.

**WRRTF Burn Pits II and IV (Site WRRTF-01) (Group 3)**—In 2000/2001, additional sampling and analysis of soil samples occurred to assess the burn pits for additional COCs. Based on the sampling, a risk assessment was performed and a recommendation was made to change the COC from lead to asbestos. The original remedy was to continue with the revised COCs.

In 2004, site preparation began, and soil cover construction revisions were made to Pits II and IV. The low areas of the soil cover were filled and compacted with clean native soil to provide a minimum of 2 ft of cover over the waste material. The cover surfaces were contoured to provide natural drainage away from the pits, and granite monuments were placed to mark the pit boundaries. A pre-final inspection site visit was conducted with the agencies on July 21, 2004. Revegetation of the WRTTF burn pit was completed in the late fall of 2004.

To complete the remedial actions associated with the burn pits, the following tasks will be performed:

- The Long-term Stewardship Program will be notified when remediation is complete and will be informed that the institutional controls need to be modified based on the remedy change.
- The sitewide institutional controls plan and the sitewide operations and maintenance plan should be revised, and a requirement for monitoring and maintenance of the revegetated area for regrowth should be added.

All documents for the WRRTF-01 burn pits remediation have been completed, except for the following:

- Pre-final inspection report
- OU 1-10 Group 1 and 3 remedial action report, which will include a detailed discussion of all remedial action activities and the removal or continued application of institutional controls.

**TSF Burn Pit (Site TSF-03) (Group 3)—**In 2001, additional sampling and analysis were performed to ascertain whether additional COCs that might not have been evaluated during the remedial investigation needed to be considered. Based on the sample results, a human health risk evaluation was conducted and showed dioxins and furans in addition to lead in the burn pit soil. As documented in the April 2003 ESD (DOE-ID 2003c), the remedial action was changed from placement of a native soil cover to excavation of the soil and disposal at the ICDF.

In 2004, the soil and debris were excavated from the burn pit. The extent of the excavation was initially based on visual evidence of the burn pit layer and the underburden. Clean soil was stockpiled for later use. X-ray fluorescence field analysis was used to confirm the excavation had removed the lead-contaminated soil. Confirmation soil sampling was conducted, and the samples were analyzed to confirm that soil above the final remediation goal and ROD-identified contaminants (lead, dioxins, furans, PCBs, and chromium) had been removed. Field screening for gamma radiation was also performed. The results of the soil samples and a risk comparison concluded that the primary contaminants had been removed and the site could be released for unrestricted use. A pre-final inspection was conducted with the agencies on June 25, 2004. Contaminated soil and debris excavated from the burn pit were disposed of at the ICDF. The excavation was backfilled and compacted with clean stockpiled soil and soil from the TAN gravel pit. The backfilled excavation was contoured, and 6 in. of topsoil was placed over the surface. Revegetation of the TSF-03 burn pit was completed in the late fall of 2004.

Completion of the remedial actions associated with the burn pit requires the following:

- Complete a data summary engineering design file report that includes the land survey and confirmation sampling results, as-built information, extent of soil excavation, and quantities of contaminated soil removed.
- Provide notice to the Long-term Stewardship Program that since contaminated soil has been removed, institutional controls are no longer required and the sitewide institutional controls plan and the sitewide operations and maintenance plan should be revised to reflect this change.
- Requirements for inspection of the native soil cover can be deleted, but monitoring and maintenance of the revegetated area for regrowth need to be added to the sitewide operations and maintenance plan.

All documents for the TSF-03 burn pit remedial actions have been completed, except for the following:

- Pre-final inspection report
- OU 1-10 Group 1 and 3 remedial action report, which will include a detailed discussion of all remedial action activities, confirmation sampling results to address the final remediation goal, and the removal of institutional controls.

### 4.2.2 Data Evaluation

***4.2.2.1 Site Inspections.*** Operations, maintenance, and institutional control inspections are conducted annually at WAG 1 sites. The following is a summary of annual inspections conducted at WAG 1 sites within the timeframe of this five-year review.

In accordance with EPA guidance, institutional control inspections were required within six months of signature of the ROD and were completed in May 2000 (DOE-ID 2000e). Yearly inspections of institutional controls have been completed since then and reported in the following documents:

- *2001 Institutional Controls Inspection, Environmental Monitoring, and Site Maintenance Report for Waste Area Group 1* (DOE-ID 2001e)
- *2002 Institutional Controls Inspection, Environmental Monitoring, and Site Maintenance Report for Waste Area Group 1* (DOE-ID 2002d)
- *FY 2003 Institutional Controls Assessment Report for Waste Area Group 1 (WAG 1)* (DOE-ID 2003h).

In 2004, institutional controls at the INL Site were compiled into a single sitewide institutional controls plan (DOE-ID 2004g). The initial sitewide inspection was reported in the *INEEL Sitewide Institutional Controls Annual Report - FY 2004* (DOE-ID 2004h).

No deficiencies have been noted during the interval covered by this five-year review. Remedial activities have progressed and are nearing completion at many sites. When the hazards at a site are removed and the site qualifies for unrestricted use, institutional controls will be removed. At the time of this review, Site TSF-03, a former burn pit, has been remediated such that the hazards have been removed. That site will qualify for removal of institutional controls pending completion of closure documentation.

Operations and maintenance activities at WAG 1 consist of annual inspections for subsidence, erosion, and evidence of animal intrusion at Sites TSF-03, -06 (Area B), -07, -09, -18, -26, and WRRTF-01. In addition, a radiological survey around the perimeters of sites TSF-06 (Area B), -07, -09, -18, and -26 is completed annually. In 2002, subsidence was observed in boreholes from earlier sampling efforts at the TSF-03 and WRRTF-01 burn pits. Repairs were subsequently performed, and no other maintenance activities were necessary within the timeframe of this five-year review.

***4.2.2.2 Cleanup Results.*** The confirmation sampling and analysis were completed for Site TSF-03, -06, and -26 soil areas to verify that the final remediation goals were met. The analytical data accumulated from these sampling events will be summarized and reported in the Group 1 and 3 remedial action report. The results of sampling for PM-2A Tank V-13 contents and of post-treatment confirmation sampling for PM-2A Tank V-14 contents will also be summarized and reported in the Group 1 and 3 remedial action report. All data obtained from ongoing remedial actions (TSF-09/18, -46, -47, -48, and -19) will be reported in the Group 2 remedial action report.

### 4.2.3 Progress since Last Review

This is the first five-year review of OU 1-10.

### 4.2.4 Technical Assessment

**Question A:** *Is the remedy functioning as intended by the decision documents?*

For the sites where remedial actions have been completed (TSF-03, TSF-06 Area B, TSF-26 PM-2A tanks site soil excavation and removal, and WRRTF-01) the remedies have been implemented as specified in the decision documents. At Sites TSF-03, -06, and -26 excavation and confirmation sampling are completed, and the areas have been backfilled as required. Native soil covers have been completed for Burn Pits II and IV within Site WRRTF-01, and Pits I and III have been identified as no-action sites that require no remedial actions. Institutional controls are in place and functioning as intended for Sites TSF-06, TSF-26, and WRRTF-01. A more detailed discussion of the functionality of the remedial actions and the results of soil sampling will be included in the final remedial action report.

Institutional controls are in place and functioning as intended at Site TSF-08 pending further assessment under OU 10-08.

At sites where remedial actions are still in progress (TSF-09/18, -19, -46, -47, -48, and -26 [PM-2A tank and contents removal and, as necessary, treatment as necessary]), remedial actions are being implemented in accordance with the OU 1-10 decision documents. At Site TSF-26, the PM-2A tanks have been removed from the ground and shipped to the ICDF. Tank V-14 has been disposed of, and treatment of Tank V-14 is pending. Ongoing remediation at Sites TSF-09/18, -19, -46, -47, and -48 is being

performed in accordance with the respective remedial design/remedial action work plans and addendums. A more detailed discussion of the functionality of the remedial actions and the results of soil sampling will be reported in the final remedial action report.

Remedial actions are in progress for six OU 1-10 sites, and the remedial actions are complete for four sites, with the remedial action report pending. The requirements have been implemented and are functioning at two sites where monitoring and/or institutional controls are the only requirements. For the two OU 1-10 sites with no-action requirements (no remedial action, monitoring, or institutional controls are required), a response to Question A is not applicable, because no action was necessary. At sites where remediation is continuing, access controls are in place to prevent unnecessary exposure to contaminants. A final assessment of the functionality of all "pending" and "to be determined" OU 1-10 remedies will be discussed in the next sitewide five-year review report.

**Question B:** *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?*

Several changes have been made to the exposure assumptions, toxicity data, cleanup levels, and RAOs associated with OU 1-10 remedial action activities. The changes are summarized in the following paragraphs.

**TSF Burn Pit (Site TSF-03)—**The original remedy specified in the 1999 OU 1-10 ROD required a native soil cover and long-term monitoring for this pit. The 2003 ESD to the ROD changed the remedy from a native soil cover and monitoring to excavation of the contaminated soil from the pit and disposal (DOE-ID 2003c).

**Reactor Vessel Burial Site (Site TSF-06, Area 10)—**The original remedy determined this to be a no-action site. Based on a reevaluation of the data, the 2004 ESD to the ROD revised the remedy to no further action (DOE-ID 2003c) with appropriate ongoing institutional controls, monitoring, and maintenance, because the risk at the site precluded unrestricted land use. The remedy has been revised, and the appropriate institutional controls, monitoring, and maintenance have been implemented.

**WRRTF Burn Pits I, II, III, and IV (Site WRRTF-01)—**Additional soil sampling and analysis took place in 2000/2001 in Pits II and IV to assess the soil for additional COCs. Based on the sampling, a risk assessment was performed and a recommendation was made to change the COC from lead to asbestos. This change to the exposure pathway and RAO, as documented in the 2003 ESD to the ROD (DOE-ID 2003c), changed the remedy from native soil covers for all four burn pits to soil covers for Pits II and IV only. Asbestos and lead above the EPA residential preliminary remediation goal were not detected in Pits I and III; therefore, Pits I and III became no-action sites.

**WRRTF Diesel Fuel Leak (Site WRRTF-13)—**The exposure assumption and cleanup levels associated with the Site WRRTF-13 changed based on the RBCA evaluation of the diesel contaminants. As discussed in the 2003 ESD to the ROD (DOE-ID 2003c), the remedy of soil excavation and land farming of the contaminated soil was changed to no remedial action required for the site, because no soil volume exceeded the action levels.

As discussed in Subsection 4.2.1, Remedial Actions, the exposure assumptions, toxicity data, cleanup levels, and RAOs have not changed for Sites TSF-06 (Area B), -07, -09, -18, -26, -46, -47, and -48.

**Question C:** *Has any other information come to light that could call into question the protectiveness of the remedy?*

No.

### 4.2.5 Technical Assessment Summary

Remedial actions have been completed at Sites TSF-03 (burn pits), -06 (Area B), -26 (PM-2A tanks soil excavation and removal), and WRRTF-01. No changes in the physical conditions of these sites have occurred that would affect the protectiveness of the remedies, and there have been no changes in the toxicity factors or risk factors for the COCs. Remedial actions are still in progress at Sites TSF-09/18, -19, -26, (PM-2A tank [V-14] contents treatment), -46, -47, and -48. Through determinations made in decision documentation, the selected remedies for Sites TSF-08 and WRRTF-13 were modified to no-action site or transfer to OU 10-08, respectively.

Based on the available data, the remedial actions at the sites have been successfully completed or are currently being completed in accordance with requirements in OU 1-10 decision documents. Although the exposure assumptions at Site WRRTF-13 have changed and the COCs at Site WRRTF-01 have been modified, these changes have not negatively impacted the performance of remedial actions for the sites. Furthermore, no new information has come to light that could call into question the protectiveness of the remedies.

### 4.2.6 Issues

No issues have been identified during the ongoing OU 1-10 remedial action activities that have not been resolved through the ROD amendment and ESDs.

### 4.2.7 Recommendations and Follow-Up Actions

It is recommended that operations and maintenance requirements at WAG 1 be revised. Activities that were required during the pre-remediation phase may no longer apply. Such activities should be discontinued.

### 4.2.8 Protectiveness Statement

OU 1-10 sites whose remedial actions are completed (i.e., Groups 1 and 3) are protective of human health and the environment. The final remedial action reports documenting that final remedial goals have been met are pending for sites whose remedies are completed; however, institutional controls are in place as necessary. Remediation of OU 1-10 Group 2 sites is in progress and expected to be protective of human health and the environment. Remediation and construction are being done in accordance with the requirements of the decision documents and design specifications included in the respective remedial design/remedial action work plans. In the interim, exposure pathways that could result in unacceptable risks are being controlled.

## 4.3 Section 4 References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